FARMERS DIGEST

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JANUARY, 1950

Volume 13 — $2.50 a Year
Number 9 — 25¢ a Copy

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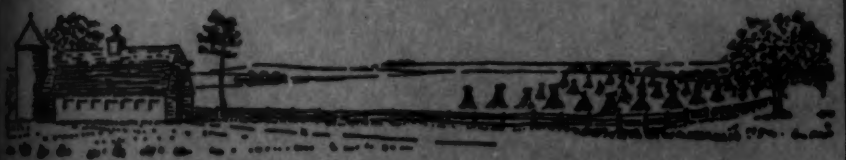

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The Farmer's Digest
Published Monthly except September at Ambler, Pennsylvania
by the Farmer's Digest, Inc.

25¢ a Copy *1 Year $2.50*
2 Years $4.50 *3 Years $6.50*
Canadian and Foreign Subscriptions $3.00 a Year

Entered as second-class matter at the Post Office at Ambler, Pa., July 30, 1948, under act of March 3, 1879. Additional entry at Lancaster, Pa.

The Farmer's Digest

Volume 13 January, 1950 Number 9

What Makes Big Yields?

Condensed from Better Crops With Plant Food

Dr. R. E. Stephenson

Soils Department, Oregon State College

THE profits in crop production depend upon good yields, low production costs, and reasonably good prices. When yields can be increased without too much increase in cost of production, profits are increased. Sometimes it is more profitable to employ practices that increase the yield per acre than to increase the acreage in crop.

So far as soil properties are concerned, yields are governed by the capacity of the soil to supply air, water, and nutrients simultaneously and in adequate amounts to the roots of the growing plants. To make a big harvest, considerable amounts of both water and nutrients must be continuously available to a well-aerated root system.

To produce 225 bushels of corn per acre, the record yield to date, would require approximately 350 pounds of nitrogen, 125 pounds of phosphoric acid, and 250 pounds of potash. In addition the corn would require nearly 50 pounds of sulfur, 60 of magnesium, 50 of calcium, one-fifth of a pound of copper, about three pounds of iron, less than two pounds of manganese, about one-half pound of zinc, and a small amount of boron. A few other things are present but, so far as is known, are mostly unnecessary for plant growth. Some of these, such as silica, may be abundant in the plant, sometimes to the extent of more than one per cent, without serving any essential function. Some elements, such as aluminum, if too abundantly present may become toxic to the plant.

Plants contain not only the elements necessary for their own growth but others not needed by the plant, yet essential for animal nutrition and health. The record corn yield mentioned would con-

Reprinted by permission from Better Crops With Plant Food
Washington, D. C., October 1949

tain about 40 pounds of chlorine, some sodium, and a small amount of cobalt and iodine, all necessary for animal nutrition. The elements which give the livestock man most concern because of their possible deficiency in forage are iodine, calcium, phosphorus, and sometimes iron and cobalt in certain areas. Thus both yield and quality of produce are of economic importance because of their significance to the health of man and animals. Both yield and quality of produce are much influenced by the quality of the soil.

Adequate moisture is as important for producing big yields as is an ample supply of available nutrients. Although corn has a lower water requirement than many plants, the 225-bushel crop would require the equivalent of about 50 inches of water for the season over each acre to furnish water enough for good growth, using 392 pounds of water to produce a pound of dry matter, the requirement reported by Kiesselbach in studying corn production on a fertile soil. This is more than the total annual precipitation, and much more than the precipitation during the period of the growth of the corn in most areas.

Corn would probably have about a six-foot root zone in the soil. The good soil may hold 12 inches of crop water at one time in six feet of depth, less than one-fourth enough to produce the corn crop if the crop used it all. Corn is produced in about four months time, during which the total precipitation and the stored moisture in the soil would usually be entirely inadequate to provide more than a fraction of the water needed for such large yields. Even with the soil at full moisture capacity when the corn was planted, and a very favorable season otherwise, and assuming little loss of moisture by direct evaporation from the soil, there is still a wide margin between the crop needs for the record yield and the usual available supply of moisture. The conclusion is that such a yield of corn would scarcely be possible, regardless of how good the soil, or how well fertilized, unless some supplemental irrigation is provided.

Moisture and nutrients in the soil are useless to the plant except when the physical soil properties are such that roots can develop profusely and function efficiently. This requires a porous sponge structure associated with a granular crumb arrangement of the soil particles. Soil structure is, therefore, the determining property so far as availability of both nutrients and moisture in the soil are concerned, and except as the roots are able to absorb oxygen from the soil, both moisture and nutrients are nearly useless to the plant even when roots are present. Good soil aeration is necessary, there-

fore, first for roots to develop adequately, and second for the roots to function after they are developed.

Things other than the soil and what it is able to furnish to the plant affect crop yields. The supply of carbon dioxide has been cited as a factor. Plants are 90 to 95 per cent carbon, hydrogen, and oxygen which air and water supply either through the soil or through the outside atmosphere. Carbon alone constitutes 40 per cent or more of the organic material of plants. To produce the 225-bushel corn yield would require nearly 40,000 pounds of carbon dioxide to furnish the carbon needed for the growth.

The atmosphere contains an average of only 4½ pounds of carbon dioxide in 10,000 pounds of air. Over an acre of soil at any one time there would be only a little more than enough carbon dioxide (about 44,000 pounds) to meet this need. Fortunately, however, carbon dioxide is continuously evolved from the soil, sometimes at rates equivalent to the use by plants. The carbon dioxide is given off by the roots of plants and is produced by various soil organisms that bring about rotting of organic matter.

Experimental work has demonstrated that plant growth can be considerably stimulated by increasing the carbon dioxide of the air about the foliage. Only one way of affecting this increase is practical, and that is by providing more organic matter in the soil to rot and give up its carbon dioxide to the soil air where it is carried to the surface and to the foliage of plants by the process of diffusion.

Forty tons of manure an acre containing 10 tons of organic matter are sometimes applied to the soil in striving for big yields. If one-fourth the organic matter is converted to carbon dioxide during the growing season of the crop, the carbon dioxide evolved would provide carbon for 2½ tons, dry weight, of new plant growth. In addition there would be the carbon dioxide from the rotting of other organic matter already in the soil and that evolved from the roots of the crop growing at the time. This evolution of carbon dioxide from rich soil manured and fertilized has been credited with contributing materially to increased crop yields.

There are, of course, several factors outside the soil that affect crop yields, such as temperature, sunshine, length of daylight during the growth period, the plant itself, and others. Some of these the grower has little direct control over, except by such procedures as choosing the planting date, spacing his plants, and selecting and breeding for high yields. The production of hybrid

corn, for example, has been credited with adding 20 to 25 per cent to corn yields.

Failure to recognize the controllable yield factors, or lack of specific knowledge for their control, is responsible for some of the low average yields and for the sometimes too prevalent tendency toward lower yields. On the other hand, the success of the best farmers in increasing their already good yields is evidence that right methods and improved practices do pay off when consistently followed.

A grower asked why his land, which once yielded 10 to 12 tons of alfalfa hay per acre, now yields only half that amount. There is perhaps no complete answer to this question that can be backed by definite proof. Probably more than one factor is contributing to the reduced yield. Insects and diseases that tend to increase at times may be part of the answer.

Considering fertility alone, the heavy yields reported if removed for 20 years (a total of 200 tons of hay) would take off 2,400 pounds of phosphoric acid or the equivalent of six tons of 20 per cent superphosphate per acre. Potassium removed would be equivalent to nearly five tons of 50 per cent muriate of potash per acre. In addition to the above, sulfur removed would be equivalent to four tons of land plaster per acre. A relatively large quantity of minor elements would be removed also. This was in an area where hay was either sold or fed without much return of manure. Even if the alfalfa, being a legume, could obtain all the nitrogen needed from the air, the other fertility losses must account for part of the reduction in hay yield.

A western Oregon wheat grower became concerned about his low wheat yields on a type of soil usually highly productive. A little inquiry revealed that the same land had produced wheat nearly continuously for 75 years. Not only the present farmer, but his father and the grandfather had been producers of wheat. An estimated 1,500 bushels of wheat per acre had been sold off the land with little fertility returned. Considering only three elements, nitrogen equivalent to more than six tons per acre of ammonium sulfate, phosphorus equivalent to nearly 2½ tons of 20 per cent superphosphate, and potassium equivalent to nearly 1½ tons of 50 per cent muriate of potash had been removed from the soil by the wheat. The fertility removal by the grain and straw was the equivalent of nearly 10 tons of fertilizer per acre, and this is only three of the 11 or 12 elements the soil must supply. Such fertility removal with little returned must become an important contributing factor to low yields.

Another farmer, who wished to

know how to fertilize to produce 100 bushels of corn per acre in western Oregon, was probably bucking an impossible climatic factor. Corn is a hot weather plant and western Oregon has little first-class corn weather. There are too many days with temperatures in the 60's and 70's, when temperatures in the 80's and 90's are better for corn. Breeding for a cool weather variety of corn may make 100-bushel yields possible, but with the present varieties 100-bushel production will rarely, if ever, occur even with irrigation and other factors made as favorable as possible.

The temperature factor is one of the important controls of both crop distribution and yields, sometimes more important than the quality of the soil. Northern Iowa is reported to have a 20-degree average temperature disadvantage—too cool for corn to do its best. The warmer southern Iowa fields out-yield those of the north, although the northern Iowa soils are likely to be more fertile.

Because of moisture limitation, as well as fertility and other things at times, western Oregon spring barley growers consider one ton of barley per acre about the top limit for production. Eastern Oregon growers with irrigation on good soils can produce two tons.

In striving for big yields, plants come to compete for standing room and light exposure in the field. Sunflowers grown in gallon cans about six inches in diameter and six inches deep, when heavily fertilized (five plants per can), yielded at a rate of more than 36 tons an acre of dry plant material. The cans had to be spaced a considerable distance apart, however, to allow the tops of the sunflowers to spread and reach a light exposure. It is not possible to grow plants in the field spaced as they were in the individual cans. Therefore, a 36-ton yield is not likely to be obtained in the field.

Since how big the yield may be depends upon a number of factors not all residing in the soil, the grower must so far as is possible identify and evaluate all the various yield factors and determine which are controllable and which are not susceptible to improvement. The grower not uncommonly puts too much faith in commercial fertilizer and pays too little attention to crop rotation, humus renewal, and the moisture supply. Because of neglect of other yield factors he gets less out of his fertilizers than would be obtained if he recognized other things which needed attention. The physical properties of the soil sometimes appear to be completely overlooked and frequently they, as much as fertility, are the limiting soil factors in the growth of plants. Soil structure for some plants, such as potatoes, is critically important and no kind or

amount of fertilizer can take the place of mellow crumb structure.

How much fertilizer can be economically used is always an important question and deserves much study to get the most from a given amount of land. The general tendency is toward more liberal fertilizer rates, perhaps due in part to soil fertility depletion and in part to a better knowledge of how to get results from fertilizing. When prices of farm products are high, fertilizer is used more liberally. Big yields are associated with profitable production, and profits contribute the means for fertilizer purchases.

Good experimental work has taken much of the guess out of what fertilizer, how much, and when and where to place it for any particular crop and soil. It is known that from 1½ to 2 pounds of nitrogen are needed to get one bushel of corn increase in yield if nitrogen is the limiting growth factor. Suppose land produces 75 bushels of corn without fertilizer and the grower decides that it is possible to try for a 150-bushel yield. He is likely to need to use 150 pounds or more of nitrogen plus the correction of whatever other controllable deficiencies exist in the soil.

In the use of fertilizers it is important to recognize that not all the fertilizer applied to the soil can be used by the immediate crop. The average for nitrogen is about 50 per cent. Much less of the phosphorus is immediately available, the actual amount being quite variable according to the form of phosphate used, the method of use, the quantity used, and the kind of crop and soil. The available portion varies from nearly nothing up to about 33 per cent. The portion of potassium fertilizer used that is immediately available seldom is as much as 50 per cent and is likely to be much less. These facts must be given consideration in planning fertilizer rates for any particular crop.

Even under the most favorable conditions a considerable portion of unused fertilizer remains in the soil held in some insoluble combination. Some may be entirely lost by leaching. Phosphates, while not much lost by leaching, may be strongly fixed in unavailable forms in the soil. Potash, likewise, may be subject to considerable fixation in the soil. Some of the fixed fertilizer may become available to other crops at some future time. The portion of fertilizer which remains in the soil raises the general fertility level by that much.

Perhaps the soil needs rest from cultivation by growing a sod crop, either grass or a legume or a mixture of both. The sod treatment will do more to improve physical properties, especially the structure, than any chemical treatment can do. Fertilizers used on

sod crops show a fruitful response not only in producing more cheap feed but in bringing about fertility improvement.

When is a corn yield likely to be bigger than after a clover or alfalfa sod? Alfalfa has a large root system to open and aerate the soil to great depth. In one report there were eight tons, dry weight, of roots under alfalfa to a depth of six feet, equivalent in organic matter and in fertility value to 32 tons of average wet stable manure per acre. Alfalfa that has been heavily fertilized followed with corn also heavily fertilized, to provide for both major and minor element deficiencies, provides physical and chemical properties of the soil that are as nearly ideal as it is practicable to make them. Assuming that there is moisture and that the spacing, planting date, and variety are well chosen, the yield should be as big as the general environment will permit.

Big yields, therefore, are dependent upon soil properties, physical, chemical, and biological; upon the available moisture supply; upon the climatic conditions; upon the hereditary properties of the plant; upon the control of insects and diseases; and upon any other factors, such as tillage, which may either limit or stimulate growth. To make big yields, the resources of the soil, the air, moisture, sunshine, and light must all be used effectively. Anything less than the most efficient control and utilization of all controllable yield factors will fail to produce the maximum harvest.

Forecasting Annual Milk Production

Condensed from the New England Homestead

BREEDERS of Ayrshire dairy cattle can now determine the annual milk production of their cows, with a maximum margin of error of only eight-tenths of one percent, on the basis of fifty to seventy day milking records.

It is expected that dairy farmers will save untold thousands of dollars every year by the scientific selection of bulls at an early date. The breeding value of bulls, whose blood strains affect milk production as well as the butterfat content in milk, can now be determined more quickly than ever before by the application of this accurate advance data.

This revolutionary development in dairy farming was announced by Henry Mosle, Chairman of the Research Committee of the Ayrshire Breeders' Association, who made the announcement after

Reprinted by permission from the New England Homestead
Springfield, Mass., October 8, 1949

the 1949 annual meeting of the Research Committee, at the headquarters of the Ayrshire Breeders' Association in Brandon, Vermont.

The accuracy of the statistical "factors" which forecast the annual milk yield of Ayrshire cows was established after a year's intensive survey by Donald Trombly, head of the Division of Records of the Ayrshire Breeder's Association. Mr. Trombly worked under the supervision of Clifford T. Conklin, executive secretary of the Association.

The Ayrshire Breeders' Association is the only group of purebred cattle breeders now providing its thousands of members with annual milk-output forecasts of their herds. Forecasts of approximately 100,000 Ayrshire cows are currently being determined, with almost perfect accuracy, by a simple analysis of their 50–70 day lactation periods.

Approximately 500 Ayrshire herds in forty states participated in the survey, in order to insure a genuine cross-section in testing the "factors." Each herd numbered from 5 to 125 cows. It was established that the 50–70 day "factors" can determine a herd's annual milk yield with 99.25% accuracy.

Mr. Mosle, Chairman of the Research Committee, stated that in order to give Ayrshire breeders the whole truth, and avoid misrepresentation of any nature, *unselected data* were used in checking the accuracy of the "factors." In other words, the widespread practice of using select cows and bulls was avoided.

"The use of unselected animals, herds and lactation records in establishing the accuracy of the 'factors' is in keeping with a long-standing policy of the Ayrshire Breeders' Association," Mr. Mosle stated. "The Ayrshire breed insists on avoiding all misrepresentation or exaggeration—by direct or indirect means— in giving Ayrshire farmers information about their herds, and in disseminating this information.

"We follow this policy of 'the whole truth' even if it may sometimes make a milk record, or a siring record, look less glamourous than if their animals, or their records, were cleverly screened. Our basic interest is in getting to the truth about transmitting values, rather than allowing breeders or anyone else to mislead the public by 'selection'—which is really just another word for 'concealment.' We believe that by telling the truth, we are performing the greatest possible service to Ayrshire farmers, the whole dairy business and the public at large."

It is considered that the greatest significance of the use of the "factors" is the ability of Ayrshire farmers now to determine the breeding value of their bulls 235 to 255 days before the completion

of the daughters' annual lactation periods (305 days).

Therefore, the farmer can now decide whether or not to continue using a bull for breeding purposes *eight* months earlier than was heretofore possible. Untold thousands of dollars will be saved by this practice. Furthermore, the use of the "factors" will enable the breeders to improve the genetic quality of the bulls in their herds more rapidly than ever before. This early building up of "blood" will result in increased milk production with higher butterfat content.

Drainage Tripled Grain Yield

Condensed from Successful Farming

Wayne T. Messerly

One reason why the Midwest is the breadbasket of the world is because its soil is underlaid and furrowed with a vast network of private and public drainage systems to carry off excess water.

How important this drainage system is to crop production can be seen by looking at an Iowa farm, where until recently, no provision was made for the disposal of top and subsoil water.

This Webster County farm, located in the heart of northwest Iowa—a heavy grain-producing area—was once considered of little value. Now, it is yielding 80-bushel corn and 70-bushel oats.

The story of its change into a valuable production unit shows how effective a good drainage program can be, helped out by crop rotation and other soil-conservation practices as used by Charles Himrod, owner.

For years unprofitable farming had been practiced on the "three short forties" in Deer Creek Township, so called because a change in the Webster-Humboldt counties' boundary line had actually reduced the farm to 105 acres.

Except for temporary corncribs, the farm was unimproved. No ordinary farmer can afford to build on land which won't return operating expenses.

Almost half the farm stood in water part of the year, or was so wet that it could not be farmed. The tillable soil was also a victim of the elements. In wet years prospects for a good crop return were far from encouraging.

All this despite the fact that open public-drainage ditch No. 1–10 cut diagonally across the farm.

Reprinted by permission from Successful Farming
Des Moines, Iowa, November 1949

The ditch had been put through in 1908. But as is often true of many drainage ditches, maintenance of No. 1–10 had been neglected.

Gouged out by an old-time steam dredge, the ditch's slope was too sharp, and its spoil banks were unleveled. Trees and weeds were allowed to grow unchecked. Soon, flow of water was blocked by a mass of vegetation and silt that also buried the few tile outlets from the "three short forties."

These outlets stemmed from the east half of the farm where about 40 acres, or less than half the place, had been tiled. Three rules of good tiling were also violated when this original tile was laid. The tile was laid too shallow, it was spaced too close together for the soil structure, and not enough tile was laid. When silt buried the tile outlets, the inadequate drainage system became useless.

This was the situation which faced Charles Himrod when he first became interested in the farm in 1946.

Like many other Cornbelt farmers, the Himrods were hard hit by the depression. But they rented a neighboring 270-acre farm in 1935 and began again. Himrod devoted 200 acres to crops while 70 acres provided hay and pasture for his large swine and beef herds. Through careful management, the Himrods gradually built up savings.

In 1946 Himrod began looking for an investment which would provide an income in future years. What better investment than land from which he had always made his living?

A local realtor called his attention to the "three short forties." Pay $10,000 for an unimproved, poorly drained 105-acre farm with water standing in spots?

Good experience with soil-conservation practices in his own farming, plus articles on the subject in farm magazines, had convinced Himrod that soil conservation pays. Why not apply it to this farm? He bought the farm in October of 1946.

His next step was to contact Louis Kuester, district soil conservationist at Fort Dodge. Kuester helped him work out a satisfactory farm plan, which was put into operation in August, 1947.

A major feature of the soil-conservation program outlined in the farm plan was the removal of standing water and the disposal of underground water.

Conservation engineers staked out 30,000 feet of tile, but advised Himrod against laying the tile until drainage ditch No. 1–10 had been cleaned. This was done in the summer of 1947.

That fall, Don Burman, Fort Dodge tiler, laid most of the 30,000 feet of tile, completing the task in the spring of 1948.

As recommended by agricul-

tural engineers, the tile was laid at a depth of 4 feet, a foot deeper than the old tile—which was removed and re-used where possible. Tile lines were placed 100 feet apart. Tile outlets are of galvanized steel, and protrude far out into the ditch.

Cost of laying the tile was nearly $100 an acre, bringing the total cost of the 105 acres to a figure that compares favorably with the average cost of farms in northwest Iowa.

But much of the land is practically virgin soil, since it was too wet to be farmed for many years.

Crop returns from the farm have justified Himrod's decision to invest in the "three short forties."

In 1947, before the farm was drained, only 48 acres could be farmed. Thirty acres produced 1,100 bushels of corn, or an average yield of 36.7 bushels per acre. Eighteen acres gave 900 bushels of oats, or 50 bushels per acre.

In 1948, after the farm was drained and put into full use, it produced 7,200 bushels of grain. *Three and one-half times as much as the previous year!*

Fifty acres yielded 4,000 bushels of corn, or 80 bushels an acre. The oats went 70 bushels per acre, with 46 acres yielding 3,200 bushels.

Better growing conditions in 1948 were partly responsible for the higher yields per acre, but Himrod believes that most of the credit goes to his soil-conservation practices.

His theory is borne out by Webster County extension and soil-conservation services' statistics. They show that in 1948, when Himrod's farm was producing 80 bushels of corn per acre, the average Webster County farm was producing only 61 bushels per acre.

He plans to put a year of meadow in his rotation program and to pasture livestock to maintain soil fertility.

Until this is done, the farm is being operated on a 2-year rotation of oats, corn, and sweet-clover catch. Green manure and oat straw also are plowed under, either at the latest date in the fall or the following spring.

Himrod is seeing that the portion of drainage ditch No. 1-10 which crosses his farm is kept free of weed and tree growth. The spoil banks were not leveled until late in 1948, thus preventing his seeding bromegrass. He therefore will spray the ditch banks *and* spoil banks this year with weed-killing chemicals, and then seed bromegrass to smother new weeds and tree sprouts.

This practice aids in keeping open drainage ditches free from silt, adding years to their potential use. It also provides a retreat for wildlife.

On Full Feed In 24 Hours

Condensed from Wallaces' Farmer & Iowa Homestead

Lee Thompson

"PUT cattle on a full feed of shelled corn in 24 hours? It can't be done." This was the reaction of one Iowa cattle feeder when he first heard of the system.

But, for the past 12 years, H. C. Hiemstra, veteran Wright county, Iowa cattle feeder, has been doing exactly that. He figures he has fed at least 500 head of cattle since he started using his system.

What about foundering? Hiemstra has never had one founder while using his 24-hour system of bringing cattle to full feed. "Sometimes they have scoured a little," he admitted. "But I've had less trouble with scouring than when I used it to put cattle on feed gradually."

Walter Passmore, Hiemstra's nephew, who farms 320 acres, has also used his uncle's 24-hour system on three bunches of feeders. Out of 85 head of steers and heifers Passmore has fed, only one has scoured. But even that one never went off feed.

This is the way Hiemstra's system works:

He usually has his cattle on alfalfa-brome pasture or on alfalfa-brome hay. "If your hay isn't good enough to make the cattle fill up well, you can add a little oats," Hiemstra says.

"Feed them all the hay they will clean up in the morning, plus a little oats if needed. As soon they clean up the hay, start feeding them corn before they get a chance to get hungry.

"I started 40 head about the first of March this year. After that bunch had cleaned up the hay, I put out about 10 scoops of shelled corn. After that was gone, I put out about 12 scoops more, and so on during the day. By evening, the cattle were on full feed.

"From then on, I feed them all the corn they'll eat twice a day," Hiemstra says.

Passmore follows the same method. "I put out the corn, then drive the cattle up to the bunks. They won't eat much corn, but they'll eat some. Then I chase them back to the feed bunks every two hours during the day," he said.

"We leave corn in the bunks overnight and keep corn in front of the cattle from then on," Passmore continued.

"The main thing," Hiemstra

Reprinted by permission from Wallaces' Farmer & Iowa Homestead
Des Moines, Iowa, September 17, 1949

says, "is not to start cattle when they are hungry. They have to be filled first. Then, when you start feeding corn, give them all they will eat the first day. You have to go all the way, or you had better not start."

Every cattle feeder knows that the touchiest point in bringing cattle to full feed is just when they are approaching full feed. By then, the cattle have developed a craving for corn. Their digestive systems aren't used to a full feed of corn. But their appetites for corn have grown.

Hiemstra's system gets away from this difficult period. He gets the cattle eating a full feed of corn before they have developed a great liking for it. He safeguards their digestive systems by making sure they are full when they are first offered corn. And he never lets them get hungry that first day.

Hiemstra says he would like to see an experiment carried out comparing his system with the usual gradual approach. He has never used a check lot to compare the two methods, but he is convinced his method is a better way to bring cattle to full feed. Twelve years of feeding cattle have proved his system in practice.

Will Hiemstra's 24-hour system work for the average feeder? We don't know. Hiemstra has fed cattle 28 years. Maybe every man can't handle cattle as he does.

If any cattle feeder decides to try the 24-hour system, he should keep in mind Hiemstra's caution: "You have to have the nerve to give the cattle a lot of corn that first day. You can't go half-way."

Half the nation's farmers can get a complete picture of their soils. Colored maps, available thru county agents, congressmen and senators, locate each type of soil on any farm studied to date. An accompanying report completely describes the soil: its depth; whether it drains well below the surface; percentage of clay, loam, gravel and other material; its texture, acidity, natural vegetation; and whether it tends to pack or erode.

Usually reports comment on the productivity of the soil, kinds of crops which can best be grown, and the practices that will increase yields.

Over the last 50 years 3,000 different soil types have been identified and classified. Eventually, say researchers, soil maps will be available for all farmers.

—Capper's Farmer

Birdsfoot Trefoil for Permanent Pastures

Condensed from Farm Science

H. D. Hughes and Maurice E. Heath

We've grown birdsfoot trefoil for a dozen years or more at Ames, Iowa. We've watched it perform on different soils, in different parts of the state, with and without soil treatments, alone and with different grasses.

More than 200 farmers in different parts of Iowa have been growing it. And we've had detailed reports from more than 60 of these. Their experience and ours suggest that broadleafed birds-foot trefoil is an unusually well suited legume for permanent pastures in Iowa. It bears up under close grazing, heat and drouth. It produces well on a rather wide range of soil conditions.

Although its stems are small and rather weak, birdsfoot trefoil is similar to alfalfa in feed value, palatability and handling quality.

Its many flowers are large, bright yellow, and pea-like in structure. These produce an abundance of seed. The pods grow about an inch long, and with several attached at one point in a way that suggests the name birdsfoot.

Ripened pods snap open as they dry, scattering the seed on the ground. This makes seed harvest rather uncertain but is excellent for maintaining good pasture stands.

We found Kentucky bluegrass, timothy and orchardgrass all well suited to growing with trefoil. Because of the weak stems, birdsfoot trefoil gives best results when grown in mixture with a grass that will help support it. Bromegrass and trefoil have done rather well under some conditions. But the aggressive southern type bromegrass we are now growing appears to offer a little too much competition.

Trefoil and bluegrass get along extremely well in spite of the sod forming nature of the bluegrass. Results obtained in Iowa, in New York and in other states indicate that when trefoil once gets established in a bluegrass pasture, it can be expected to continue indefinitely.

This is particularly fortunate since most of our permanent pastures in Iowa are bluegrass pastures.

We seeded birdsfoot trefoil in a very thin, eroded, infertile, southwest slope on the Albia Pas-

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Iowa State College, Ames, Iowa, March 1949

ture Improvement Farm in early April, 1942. Grazing cattle kept the trefoil and grass eaten just as closely as they could bite it off through seven grazing seasons—from early spring until the ground froze in the fall. Still the trefoil thickened and spread in each of these years.

Obviously, close grazing prevents the best production of either the grass or the legume. Such treatment certainly is not recommended. But the suitability of the trefoil grown with Kentucky bluegrass is well demonstrated by this test. It shows that it can stand the severe abuse which so many permanent pastures are subject to.

Where it is difficult to get grasses established, you may get best results from seeding trefoil with orchardgrass. Often you can get a good stand of orchardgrass when other grass seedings fail. And these two grow well together. Orchardgrass is a productive, rapid growing pasture grass.

Thus far not a single case of bloat on birdsfoot trefoil pasture has been reported. This includes the work in New York and the Pacific Northwest where trefoil pastures have been grazed for 15 years and more.

Birdsfoot trefoil is rather slow in getting started. Plants are unusually small and weak in the seeding year. You probably won't get full production until the third year. For this reason, birdsfoot trefoil is not the legume to seed on land to be included in a rotation. Its place is in permanent pasture.

When harvested as hay, it remains in good condition for cutting for a rather long period of time. It usually is cut for hay somewhat later than alfalfa, when weather conditions are more favorable for curing. Trefoil is slow in starting growth again after it has been cut. The plants continue leafy and in good condition for hay even after the seed has ripened.

It is said that the first trefoil seed probably came into this country in some ship ballast that was dumped along the lower Hudson River in New York state. From there the plant worked its way out into the country. It spread along the roadsides and into pastures and meadows. In time it established itself in poor pastures and meadows in the vicinity of Preston Hollow, in Albany County, New York.

People soon noticed the unusual yield and quality of this new forage. Finally, it came to the attention of the New York Experiment Station at Cornell. Crop scientists at that station first studied birdsfoot trefoil in 1934. And the work there led to trials in Iowa and in several other states.

Both in Europe and New York, birdsfoot trefoil has developed a

reputation for its ability to maintain itself and produce good yields on the less fertile soils. The story is the same in Iowa.

It is much more tolerant of acid soil conditions than is alfalfa or sweetclover. Tests on the Howard County Experimental Farm show that it compares with alsike and red clover in acid tolerance. And we've already mentioned its performance on thin soils that were overgrazed.

But like all crops, birdsfoot trefoil does its best when properly fertilized. It responds well to liming. New York growers, who have had the most experience with this legume, are strong for phosphate fertilization. On eroded Clarion silt loam at Ames, we increased yields 60 percent (average for 4 years) by applying 200 pounds of 0-20-0 fertilizer dressing about every 3 or 4 years.

Birdsfoot trefoil takes a special type of inoculation. Clover and alfalfa inoculation have no effect on it. So be sure to get the proper inoculation material when you get your seed. We prefer to use a pure culture obtained from the seed dealer, plus soil from around growing trefoil plants as a sort of double insurance. We don't believe that the birdsfoot trefoil nodule bacteria are found in any of our Iowa soils.

For permanent pasture seedings, do a thorough job of renovating your old bluegrass sod. Tear up the bluegrass as though you were fitting it for a crop of corn. It may be shallow-plowed on the contour in late fall or early spring, then disked and firmed thoroughly. A spring-toothed harrow followed by the disk will do a good job also. One of the best jobs can be done with a field cultivator, such as is now available for most tractors.

Apply limestone if your soil needs it. Then put on 200 or 300 pounds of superphosphate, disking it into the surface in preparing the seedbed. You may want to test your soil before doing this; but most old permanent pastures need some lime and phosphate.

After harrowing to smooth, sow 4 to 5 pounds of birdsfoot trefoil seed per acre. Broadcast on the surface; follow with a cultipacker or a corrugated roller to give the seed proper depth and to firm the surface soil. If there isn't too much grass you may prefer to disk in 1½ to 2 bushels of oats per acre. Begin grazing this when it is 8 to 10 inches high. Adding 3 to 4 pounds of red clover per acre may provide more pasture while the trefoil is getting established.

Don't expect too much from your trefoil in the seeding year, or even in the second year. But after that you should have high producing pasture forage that will definitely boost the yield of your permanent pasture — and keep right on doing it.

We've seen excellent stands with unusually strong plants from June and July seedings. A few late summer seedings also have resulted in good stands. So far, however, we have found that the safest method is to seed early in the spring, just as you seed clovers and alfalfa.

The broadleaf trefoil is the only variety adapted to Iowa conditions. However, there are also the narrowleafed trefoil and the big trefoil. The narrowleafed has been a good pasture crop in New York and in the Pacific coast states. It is best suited to the more moist soils. The big trefoil, which roots from underground runners, is best suited to poorly drained soils. Neither of these seems to have the winterhardiness of the broadleafed type. They are not well suited to growing under Iowa conditions.

There are several strains of the broadleafed trefoil. The New York strain, especially that tracing back to the Preston Hollow area, seems to be the best for use in Iowa.

The New York Crop Improvement Association is certifying birdsfoot trefoil seed that traces back to the Preston Hollow strain as "Empire Lotus." Most of this seed is handled by the Eastern New York Birdsfoot Trefoil Association with headquarters at Delmar, New York. They do not retail any seed, but distribute to seed jobbers and dealers.

Because of the demand for trefoil seed and the uncertainty of seed harvest, seed costs have been high. Certified seed from New York has been selling at about $2.25 to $3.00 per pound.

This high price has stimulated imports of seed from Europe. Quite a little of this has come into the United States during the past few years. So far as is known, all of this is of the broadleafed type.

Our trials with European seed suggest that it is not as resistant to winter injury as the New York strain of trefoil. Also, the ability of the European strains to maintain themselves over a period of years has not yet been determined. Some local dealers are offering the European seed as low as $1.00 a pound. Others are asking considerably more.

The harvest of trefoil seed is uncertain. Some Iowa growers have tried to produce a seed crop through several seasons—with very little success. If the ripened pods become wet and then dry out again, they may split open.

At our pasture Improvement Farm at Albia, however, we harvested ¾ acre of trefoil in 1944 which netted 171 pounds of seed per acre. This was windrowed as it was cut, then thrown into the stack a couple of days later. We covered the stack well and let it

stand for about 3 weeks before threshing.

This was trefoil we had seeded into an old Kentucky bluegrass pasture as a part of a renovation experiment 4 years before. We had set the grass back rather thoroughly by disking; and had also applied lime and superphosphate—the usual procedure when renovating old bluegrass pasture. This has been kept close grazed since 1944. We hope to take another seed crop this summer.

This last summer (1948) we harvested 1.3 acres of trefoil for seed. This was part of a larger area at the Albia pasture farm in which birdsfoot trefoil had been seeded into a poor stand of Kentucky bluegrass and redtop in 1944. The stand was grazed each year until 1948, when it was left for a seed crop.

We cut this on a Friday—most of the seed pods were beginning to dry and were a dark violet to brown in color—windrowed it on Saturday morning. Sunday it rained 2 inches; and on Monday another 1.3 inches. By turning the windrows carefully, however, it was possible to cure the crop without serious loss from shattering. The crop was combined a week from the day it was cut, yielding 119 pounds of clean, No. 1 seed per acre.

In New York they commonly windrow immediately or very shortly after cutting, then combine as soon as the crop is sufficiently well cured. They usually take the first crop for seed, pasturing the second.

Another procedure is to pasture in the early part of the season, or cut for hay or silage by early June. Then the seed crop is taken late in the summer from the second growth. This might have some weather advantages during the harvest season.

There seems to be no doubt that honeybees are important to good seed setting in a birdsfoot trefoil. This legume is practically self-sterile; it depends almost entirely upon insects for pollination. In 1947 a 7½-acre field in southern Minnesota produced 200 pounds of seed per acre, with 25 hives of bees near by. The bees worked on the flowers with great vigor. Colonies which were weak at the beginning of the season developed into strong ones, averaging 160 pounds of honey each.

Iowa farmers have long needed a hardy, high producing legume for use in permanent pastures—one that could stand the rigors of winter weather as well as abuse from overgrazing. We have been recommending sweetclover for permanent pasture renovation. But careful grazing management is needed to get good reseeding. Seldom has sweetclover maintained itself very long under normal pasture use.

Now the sweetclover weevil is

becoming a serious problem, making sweetclover still less dependable. Red clover and alsike don't reseed themselves in pasture very well because the cattle eat off the blossoms.

Birdsfoot trefoil has many of the qualities needed in a pasture crop for Iowa. It's not perfect, but it shows great promise.

Advantages: Deep-rooted perennial, heat and drouth resistant—wide soil tolerance — produces seed abundantly, reseeding even when close grazed—vigorous, with acre production when well established—palatable and with high feed value—able to maintain itself in competition with sod forming grasses, such as bluegrass—can survive severe grazing abuses —winter-hardy—no bloat as yet.

Weaknesses: Slow in establishment—seed costs high, owing to difficulties in seed harvest—weak stems, it lodges easily when grown alone.

Unload Feed by Suction

How about a vacuum-blower to unload and elevate silage, chopped hay or small grain from wagon or truck? Cornell University engineers have been testing such a machine.

The blower may be powered either by an engine on the same base, or by a tractor. Feed is elevated thru a 14-inch metal tube. A flexible tube, same diameter, supported by a counterweight is connected to the blower inlet thru a 90-degree and a 45-degree elbow. A 3-foot length of straight pipe with a ring handle is used to pick up the load. To prevent stoppage of air flow. 10 holes of 1-inch diameter are cut close to the inlet end.

The elevator pipe is 6-foot sections with coupling flanges. Feed enters under suction, passes thru the fan and is blown into silo or other storage. Air can escape thru silo doors or building openings.

Engineers point out this machine has some disadvantages. It is not a power saver. Fifteen to 25 horsepower are required to drive the fan. Also it is more dfficult to set up the larger pipe. Manufacturer of the unit says it is ideal equipment for use with a field chopper. One man can unload from any truck or wagon, as long as the top is not covered. The vacuum-blower can also be used for drying hay, or grain and for special ventilating jobs.

—Capper's Farmer

Lush Meadows On Run-Down Hills

Condensed from Hoard's Dairyman

S. R. Winters

RUN-DOWN hilltop pastures may be transformed into lush meadows in a single season through approved pasture renovation practices. Formerly it required 10 acres of eroded hillsides in Northwestern Pennsylvania to support one dairy cow. Now the soil is being saved for posterity. Forage crops grown in three years, when turned into hay and silage, have multiplied a meadow's carrying capacity, supporting not one cow but large herds of dairy cows.

Grassland farming is resulting in a major shuffling of agriculture in the Keystone State. Pasture renovation in Northwest Pennsylvania has been in progress for about six years. These studies by Pennsylvania State College have been searching: the results conclusive. The lessons learned have been basic and far-reaching. These research workers have disclosed that soil of abandoned land, subject to renovation, must be deep enough to retain water necessary to sustain plant growth throughout the hot summer months; otherwise, the project is hopeless. Acidity and fertility may be corrected but if the soil is thin, droughty, and shale, it may be only fit for reforestation.

Many acres of abandoned lands are being converted into A-1 meadows through newly developed renovation methods. The cost of conversion is high—from $35 to $50 an acre, but in repeated experiments the expenses of pasture renovation have been "squared off" the first year by the multiplied output of forage.

During these years, dairy husbandmen have determined that rotation management is best for legume-grass meadow. That is, pasture plots of orchard grass—ladino clover, planned and executed with deferred spring grazing, and rotational grazing thereafter—yield the greatest amount of dairy cattle feedstuff. However, the production of these plots, as well as those which were first harvested and then rotationally grazed, have declined greatly. This abrupt falling off in legume-grass meadow yield prompts authorities in charge of the project to caution anyone about drawing positive conclusions. The trials are continuing for another five years.

There are, however, certain

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Fort Atkinson, Wisconsin, September 25, 1949

definite lessons to be learned from experiments already completed. For example, in an approved dairy farm program of feeding there should be enough fields of orchard grass and ladino clover to meet the pasture demand of late summer. The system of management should be rotated. One field, for instance, can be grazed in early spring, a second could be reserved for deferred spring grazing, and a third field for grass silage followed by rotational grazing. Silage could be taken from first and second fields, if the saving of forage dictates as much, but each treatment should be rotated every year.

Bromegrass-alfalfa, reports the Pennsylvania Experiment Station, yields more silage than four other grass-legume combinations in a study in which the first crop was harvested for silage and the aftermath grazed. However, orchard grass-alfalfa has a quicker comeback than any other combination and is the greatest yielder of aftermath grazing and of forage for a whole season.

Weed-choked pastures, miserly in yields, have been renovated at a profit, notwithstanding mounting costs of seeding, fertilizing, and liming. Some of this Pennsylvania land is hilly, stony, and not well drained. Roughness of the land, together with the liabilities of soil erosion, dictates that valuable grasses and legumes must be established with very little cultivation. Furthermore, abused and worthless land can be retrieved for productive uses by letting it "rest" and then top-dressing the soil with manure, limestone, and fertilizer. Other "barren" lands cannot be rescued without heavy applications of manure and commercial fertilizer, thorough tillage, and complete reseeding.

The 6-year-old pasture renewal tests in progress in Pennsylvania (they are being continued) have fallen into three categories. First, new "blood" can be injected into existing but apparently worthless soil by applying lime and fertilizer. This is followed by approved management practices. Ordinarily, quality grasses and legumes will return to productivity without the necessity of reseeding.

The second set of conditions involves seedbed preparation, requiring pulverization of existing sod with a heavy disk, spring-tooth harrow, field cultivator, or other implement. Old sod lends itself best to working in August or September, when the vitality of the soil is at a low ebb. Cut-up sod, roots, and other matter, at or near the surface, will contribute organic materials to the land and also assist in preventing soil erosion. Such land can then be reseeded in early spring, without a nurse crop, using any desirable combination of seed.

The third group of conditions under which pasture renovation is

achieved involves crop rotation for completely destroying any vegetation present. Corn, for example, or some other cultivated crop, may be grown the first year. For the succeeding year, a cereal crop (oats, barley, or wheat) may be raised, in which the grass-legume mixture is seeded. The third, or succeeding, crop may be hay, grass, pasture, or a suitable combination. In rekindling the productivity of this kind of sod, liberal fertilization and liming are resorted to when the cereal crop is planted.

Seeding combinations at the U. S. Regional Pasture Research Laboratory and Pennsylvania State College are not arbitrary but there is a well defined trend favoring larger growing grasses and legumes. A top favorite is ladino clover and orchard grass mixture. Other combinations of ranking consideration are: orchard grass with alfalfa; bromegrass with alfalfa or bromegrass with ladino clover. In compounding the seed mixture, we are told, keep the rate of grass seeding low, so that it will not conflict unduly with perpetuation of the allied legume. For instance, in some cases it may be advisable to include two pounds of red clover to each mixture to insure stepped-up yields for the first and second years.

One of the most vital considerations in pasture renewal is proper management during the seeding year. If the sod is seeded in March, grass will be available for grazing from July to September of that same year. Moderate grazing is advisable—overgrazing during this critical period may be done at the expense of a more durable and better sod. However, following the seeding year, a revitalized pasture yields more feedstuffs during midsummer than most permanent pastures produce during a whole year. Hay, silage, or pasture may be obtained from renovated land.

Pasture improvement, like other endeavors may have a humble beginning. Such was the long-time program of Penn State College, when 8 years ago P. D. Jones, the College dairyman, started the project in a small way. Two years later this bit of improved pasture received 8 loads of stable manure, each buttressed with 250 lbs. of ground limestone and 50 lbs. of superphosphate to the acre. A year later 8 loads of chicken manure were spread to the acre. Bluegrass and redtop thrived and grew so fast on the better plots of the field that grass and weeds were eliminated and pasturing followed.

In the fall of 1943, three years after the improved pasture project was born, a bush and bog harrow was employed in pulverizing the sod. In April of the succeeding year the ground was given the twice-over with a disk and also

twice cut-up with a spring-tooth harrow. Then the field was seeded to ladino clover, one pound to the acre. The soil was cultipacked after seeding.

A bountiful crop of A-1 clover hay was harvested in 1945. Only ladino clover was seeded; bluegrass burst out naturally and in strength. During 1944 this field was grazed and also cut. The following year a hay crop was produced and the revitalized area was also grazed.

Two years ago this pasture was devoted almost exclusively to nurturing a large herd of dairy cattle. Exact comparative measurements of three sections of the field were taken during the summer to find out both yield and percentage of clover present. The percentage of clover was 58.1 on the renovated area which produced 2,181 pounds of air-dry forage per acre. The actual yield was greater, inasmuch as measurements were made while the pasture was being grazed. Another section of the field, fertilized but not renovated, produced 1,390 pounds of air-dry forage with only 1 per cent clover present. Total yields for the season were more than twice the figures listed. However, the untreated, non-renovated portion of the field—still choked with weeds—yielded only 201 lbs. green stuff to the acre and no clover was present.

Pennsylvania State College authorities admit receiving some criticism that treatments given this renovated area cost much more than the idle land is worth. Their answer is: if poultry manure is appraised in line with plant nutrients contained, $4 or $5 a ton, this criticism is justifiable. But if hay is worth $20 per ton and pasturage is appraised by the same yardstick, this venture in revitalizing abandoned lands is sound economically. A detailed statistical table on these grass-legume fertility tests, second-year yields in Crawford County, lends further impressiveness to the value of pasture renovation.

In the Penn State College pasture renewal tests, the moldboard plow required the least human effort to the acre and it performed very well in killing existing vegetation which was necessary in perparing the seedbed. The first year's growth of grass, however, was lower with plowing but for succeeding years there was no appreciable difference in grass-legume yields. On the debit side, the moldboard plow is responsible for more erosion on sloping land.

Disk harrows, 16- or 18-inch disks, are not sufficiently strong to withstand heavy weighting down in order to penetrate the sod adequately. Also it is necessary to make many duplicate trips over a given area to completely destroy the old sod. Therefore, the ordinary disk harrow is valuable

only after the sod has been pulverized by some other machine.

A field cultivator (an implement with considerably stiffer teeth than the usual spring-tooth harrow) can kill the old sod with two trips over and with a reasonable amount of work to the acre. The teeth of this device, however, should be set in three rows, thus obviating clogging.

The cover crop disk (a tandem disk with 22 to 24-inch disks, spaced 9 inches apart) mixed the organic matter well with the soil, but it has to be weighted down and make three trips over the same acre. Desirably so, it leaves the field in reasonably good condition to withstand the assaults of erosion.

By using a disk plow, followed by a heavy cover-crop disk, the results were comparable to the effects of using a heavy cover crop disk.

GRASS-LEGUME SOIL FERTILITY EXPERIMENTS

Treatments—Lbs. per Acre			Air Dry Hay Weights—Lbs. per Acre				
Ground Limestone	20% Superphosphate	60% Muriate Potash	Alfalfa	Alfalfa-Bromegrass	Ladino Clover	Ladino-Orchard grass	Per Acre Cost of Lime and Fertilizer
000	000	000	All weeds 300 All weeds	Nothing All weeds	Nothing Mostly weeds	Nothing 90% weeds	$ 0.00
000	750	250	1090 99% weeds	1060	1385	1680	16.85
1000	750	000	1480 80% weeds	2360 20% weeds	2900	2880	12.95
1000	750	250	1740 20% weeds	3010	2860	3190	19.85
2000	250	000	1400 15% weeds	2640	1940	2750	10.65
2000	250	83	1326 Some weeds	1920	2000	3600	12.95
2000	500	83	1940	3100	2160	3170	15.60
2000	750	250	1760	3860	2425	3270 20% weeds	22.85
4000	000	250	1310	1920	1615	2100	20.90
4000	250	83	1820	5030	2785	4350	18.95
4000	250	250	1880	4770	2540	4710	23.55
4000	500	000	1870	4270	2320	4140	19.30
4000	500	83	2035	4820	1920	4380	21.60
4000	500	160	2520	5260	2440	4660	23.70
4000	500	250	2680	5180	2540	4560	26.20
4000	750	000	2920	5140	2625	4800	21.95
4000	750	83	2700	4560	3020	4630	24.25
4000	750	160	2520	4940	2690	4860	26.35
4000	750	250	2680	5180	2900	4090	28.85
6000	750	250	2560	5730	3120	4800	34.85
8000	750	250	2770	6120	3400	4540	40.85
8000	1500	500	2730	7900	2700	5480	55.70

All fertilized plots received 187 pounds sodium nitrate fertilizer per acre. (30 lbs. N.) These are second-year yields. Yields the first year of the test were comparable and provided forage worth all that the experiment cost.

Soil Will Tell Your Fortune

Condensed from Nation's Business

J. D. Ratcliff

WE LOVE our soil, or hate it; live by it and die for it. And, say the soil scientists, we are all pretty much what our soil makes us.

The Vermont farmer scowls at the shiftless Alabama sharecropper. But if *his* grandfather had settled in Alabama he would probably be in the same spot himself—wearing tattered overalls, and kicking hogs off a sagging porch.

We have heard a great deal about what man has done to the soil—how he has misused it, despoiled it. But we have heard almost nothing of what soil has done—and is doing—to man himself. The dirt under our feet influences us in a hundred subtle ways. It influences character, body build, mental processes. To a degree, it even determines how we vote!

The northeast is notoriously conservative, the West generally liberal. Perfectly understandable, say the soil scientists. A New England farm has soil which, when cultivated, grows anything. This leads to self-sufficiency, and self-sufficiency leads to conservatism. Meanwhile, prairie soil produces only one crop: wheat. Farmers there have to cooperate or die—and cooperation pushes to the political left. The soil scientist, therefore, *expects* Nebraska to produce men like the late George Norris, great proponent of public power; and is not surprised to find that Vladimir Ilyich Lenin, leader of the Russian revolution, was born in Ulianovsk, a grain-belt province with soil much like that in our own West.

Dr. Charles E. Kellogg, head of the Department of Agriculture's Soil Survey, has done more than anyone else in tracing these subtle influences that soil has on man. One of the world's top soil scientists—he has been adviser to the Belgian, French, and other governments—he has a striking point to make about the Civil War. The line surveyed by Charles Mason and Jeremiah Dixon is generally regarded as the boundary between North and South. A soil map is a far better guide, Kellogg contends.

Where the brown forest soils of the North dipped into the red-yellow soils of the South, Lincoln got recruits. Thus, West Virginia, which has northern-type soil, split

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Washington, D. C., February 1949

away from its parent state to join the Union. A finger of northern soil dips down through eastern Tennessee—and people in this area petitioned the northern Congress for admission into the Union. This same finger of brown soil continues on into northern Georgia—and the people who lived on it tried to secede from the Confederacy. Where the red southern soils pushed northward, the story was reversed. Missouri is a good case in point. With half northern and half southern soil, this state was split wide open.

Kellogg, an amiable and garrulous philosopher as well as a scientist, finds dozens of instances where soil has influenced our national history. Whenever large masses of people move from one soil type to another, an emotional explosion is apt to follow. This happened in the settling of our own West. It was the Wild West until people became adjusted to a new soil. Then six-guns were put away.

This discontent with alien soils is expressed in many ways. Even in the matter of music, soil exerts its influence. The mountaineers of Albania and Kentucky have much the same music. The plaintive wails of the Nebraska plainsman would be familiar and pleasing to the ears of the wheat farmer on the Russian steppes, or the Argentine pampas.

Soil even plays a part in determining body shape. Where calcium and phosphorous are lacking, human beings tend to conserve these bone-building minerals. Thus, the people of India are smaller than the people of Sweden; the Japs are smaller than Texans. Where iodine is lacking in the soil, the thyroid of the neck swells in an effort to utilize every scrap of the chemical available. This happens in the Himalayas and natives refer contemptuously to outsiders as "Little Necks."

Since soil goes such a long way in determining what we are and how we behave, let's have a closer look at it.

We regard it as a dead, inert stuff. Actually, it is miraculously alive. It is the bridge between the dead rocks and all living material —plants, animals, man. The soil itself teems with life. A fleck of dirt the size of a pencil eraser may contain more than 2,000,000,000 microbes—more than there are people on earth. The soil supports an incredible variety of microfauna: worms, ants, centipedes. It is the scene of chemical reactions more intricate than any performed in laboratories. It changes from month to month, day to day, and even minute to minute.

Creation of the thin skin of topsoil which keeps the human race alive is the supreme miracle of the universe. A river at flood stage may lay down a foot of

topsoil in an hour's time. On the other hand, it may take 10,000,000 to build a foot of soil, on the slopes of a mountain.

Dozens of forces are constantly at work weathering rock into soil. The sun heats rocks, chill night winds cool them and they crack. Winter rain enters crevices, freezes, pries smaller pieces apart. Rain dissolves carbon dioxide from the air to make carbonic acid—which eats away rock particles.

Trees and other plants act as pumps. Their roots suck mineral nourishment from rocks below the surface, and incorporate this in leaves and trunks. When plants die they leave these minerals on the surface—making a considerable contribution to soil fertility. In the tropics, plants may contribute as much as 90 tons of humus a year to the soil—in arid regions it may be no more than a few pounds. The rich, black soils of the prairie states represent the accumulated rot of grasses that have grown in these areas tens of thousands of years.

Similarly, microbes make their contribution to soil fertility. Some of them extract nitrogen from the air, incorporate it in their tissues and leave this valuable fertilizer in the ground when they die.

While the process of soil formation has been quite well understood for some time, the soil itself remained an enigma. Thoughtful men studied the stars, invented mathematics, probed biological function—but let the soil which supported them severely alone. Almost nothing was known of its inner mechanics until quite recently. To be sure, the first farmers—and agriculture is as old as civilization—had a certain crude fact to work with. They knew that manure helped crops along, and that land allowed to lie fallow was more productive. The Greeks and Romans wrote knowingly about these things—indicating that there was nothing very new or exciting about them 2,000 years ago.

Yet, for years it was seriously proposed that crops *ate* soil. Jean van Helmont, seventeenth century Dutch scientist, scotched this one. He carefully weighed soil in a tub, then planted a tree in it. By the end of five years, the tree was head-high, weighed many pounds. But the soil in the tub had lost only two ounces in weight. Van Helmont had discovered something—but he didn't know what. He lamely concluded that water was the "spirit" of vegetation, and let the matter drop. If this were so, said a British scientist named Woodward, plants should grow in water alone. He tried this experiment—and nothing happened.

Another 200 years had to pass after van Helmont made his observations before any start could

be made on a real understanding of the soil. Then, a century ago, Justus von Liebig, a German of towering research intellect, attacked the problem.

By careful analysis, he discovered that the soil contains an incredible array of minerals and chemical substances. This appealed to von Liebig's orderly mind. The soil, he decreed, was nothing more than a vast storage bin. Plants drew on it for mineral nourishment and when minerals were exhausted the soil ceased to produce. The soil, in other words, was very much like a bank. Plants made withdrawals, and man made deposits—in the form of fertilizer.

On paper, von Liebig's idea looked beautiful. But there were many things wrong with it—as von Liebig discovered on a trip to the Danube basin. There he found soils which had been producing crops for centuries when, according to his calculations, they should have been exhausted by the time the Romans left. What was the answer? He didn't know.

Another generation passed and a Russian—V. V. Dokuchaiev—got on the right track at last. Instead of regarding soil as a dead stuff, and studying it in the laboratory as von Liebig had, he took a spade to the fields. He stripped away soil down to solid rock, and started studying the various layers which built up the soil "profile."

He saw that soil formation is a continuous process—roots pulling mineral nourishment up from below, rain washing it back down again. He noted that the same kind of rock could produce dozens of kinds of soil—depending on climate, vegetation, and other factors. More important, he observed that soil is always an expression of the vegetation growing on it. That is to say that the wheatlands of the Dakotas have a profile similar to that of wheatlands in India; that soils under pine forests throughout the world were always the same.

Although Dokuchaiev did his pioneer work in 1870, the language barrier kept word of his work from America and the rest of the English-speaking world until the early '20's. Then a new concept of the soil science was born. Look at the picture today. There are more than 10,000 types of soil, which fall into 50 odd great soil groups. By now, the world is almost completely soil mapped and these maps tell with astonishing exactitude what crops will grow in what areas. Without ever seeing China, India, or Italy, a soil scientist can look at such a map and say which land will produce corn, where sugar cane may be grown, which areas will support orchards. Similarly, these

maps are used to predict crop yields. A soil scientist knows that the Robinsonville sandy loam of Mississippi will produce 700 pounds of cotton per acre; that the Tama silt loam of Iowa is good for 70 bushels of corn per acre; that the Deep Lakeland soil of Florida won't produce much of anything except worthless cabbage palms.

In general, three great soil groups dominate American farm economy. Podzolic soils — once covered the forest—dominate in the East. They are exactly like the soils of Europe, hence the pioneers who settled on them faced few problems. They brought Old World seeds with them and they thrived in the New World. Soils of this type will grow almost any crop. Hence, the farmer is independent. Depressions hurt—but they don't wipe him out the way 50 cent wheat ruins farmers in the grain belt.

Note something else about this area. There is a widespread notion that the first farmers who cleared the forest found a rich, lush land. This isn't so. The Podzolic soils were never very good. To be sure, they grew trees—but the poorest land will support a tree crop. In sum, then, the "worn out" farms one may see in New England today weren't very good to start with. On the other hand, Podzolic soils have one great point in their favor. They respond to good farm management. Great areas in the East have had this good management—farms in the Pennsylvania Dutch country, Connecticut tobacco farms, for example—they are many times more productive today than they were in pioneer times.

The South, with its red-yellow soils, presented another set of problems. Such soils are best suited to growing crops like cotton and tobacco—both of which require large amounts of labor. This pushed the South toward plantation-type agriculture.

Raising more of these crops than the country could consume, the South had to export. Free trade was the cry of plantation owners, whereas the North wanted restrictive trade barriers to protect its infant industries. Thus, political and economic rivalry began—and led, inevitably, to war. The question of slavery got the headlines, but it was more or less incidental to the larger issues.

The Chernozem soils of the prairie states posed a different set of problems. In this arid region, there is too little rainfall to support forests. Hence, for tens of thousands of years, this area produced crop after crop of grass. This grass rotted each year, eventually built up the thick black soils of Nebraska, the Dakotas, and other grain states. Meanwhile, exactly the same thing was

happening in other places in the world: on the Russian steppes, the Argentine pampas, Rumania's grain belt.

These blacklands were ideally suited to wheat. But they had to await the coming of railroads to go into production. Until the trains came, there was no way to transport the crop. Hence, these lands—which now produce the bulk of the world's bread—have been farmed only in recent times.

A fourth great group of soils are those laid down by rivers—the alluvial soils, which produce a third of the world's food. The building process which creates such areas as the vast Mississippi Delta—which "begins in the lobby of the Peabody Hotel in Memphis and ends on Catfish Row in Vicksburg"—is almost incomprehensible. The Nile Delta, for example, contains the equivalent of 12,000 cubic miles of rock.

'Cows' Up a Tree

Condensed from The Rotarian

Paul W. Kearney

ODDLY enough, the largest and the smallest livestock domesticated by man are both native to India. In the first category, the five-ton elephant needs no introduction. But, in the second, *Tachardia lacca* does. An insect measuring about one-fifteenth of an inch in length, it provides India with upward of 25 dollars' worth of income a year. Phonograph records are made of its end product. It supplies the glaze on playing cards. It is the stiffening used in every felt hat made. It is the bonding cement used in the seams of tin cans, in electric-light bulbs, in vacuum cleaners.

In a word, it is shellac.

Everybody uses it, chiefly as a protective coating for furniture and woodwork. Yet if you should ask, on a radio quiz, whether shellac is animal, mineral, or vegetable, it is doubtful if one person in 100 would know the answer.

Actually, shellac is the product of the lac bug—a pest which feeds and breeds on certain native trees in parts of India, notably the Northeastern Province of Assam. Although it is believed that there is only one male for each 5,000

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55 East Wacker Drive, Chicago, Ill., October 1949

females, the breeding is so prolific that the name is thought to have derived from the Hindu word lakh, meaning "a hundred thousand."

Attaching themselves to the tender shoots of their host trees, the insects pierce the bark and feed on the sap. After several years they will weaken and, perhaps kill the tree. But in the meantime they exude a reddish resinous secretion which covers each bug like a tent and under which myriads of eggs are laid. As these eggs hatch, the young gradually swarm all over the branch, seeking a place to settle down for their half year's existence. And as generation follows generation, this natural plastic coating under which they live and die often becomes half an inch thick.

Thus is produced the raw material for more than 50 million pounds of shellac exported annually, 75 percent of it going to the United States. And although there are firms in the U.S.A. that have been importing it for well over a century, the production end of the business still remains the primitive, "cottage industry" that it has always been.

The typical lac breeder has two or three open-hearth fires with which he processes only a maund (82 pounds) or two of resin a season, to be sold to the local bazaar and ultimately gathered up by agents for the Calcutta exporters. A large plant may have 30 or 40 fires, but these are few and far between.

As far as production goes, Nature takes care of that on a remarkable assembly-line sytem. The breeder's chief problem is to avoid congestion in each succeeding generation of lac bugs so as to provide all the newcomers with enough to eat. For if a newly hatched bug doesn't find a food supply—i.e., a tender twig—within a distance of about 12 feet from its birthplace, it just curls up and dies.

The standard practice, therefore, is to keep inoculating fresh trees with this parasite. About a month before the swarming period sets in, orange spots appear on the females: the signal for the breeder to get busy. For the females stop feeding now and begin to concentrate on their expectancy. Hence this is the time to transfer them from their established food supply and start a new colony.

Twigs loaded with healthy lac insects are cut off the tree. Some growers wedge these sticks of "brood lac" between two twigs of a fresh tree. Others put several infected twigs in a bamboo basket which is tied to the tree among succulent new shoots. Generally it takes a full day for an experienced man to inoculate a fresh tree.

The swarming periods come twice a year, approximately in May and October, one swarm being used for blood, the other for crop. And the conversion of this second batch into a marketable commodity involves considerable tedious labor.

First, thickly encrusted twigs of "stick lac" are cut off the trees and either scraped, soaked in water, or pounded and split to remove the lac, which is then spread out in the shade to dry. Crude stone mills or corn crushers are usually used for this process. The stuff is then repeatedly winnowed to separate the lac from the sticks and dirt. Then it is washed and put to soak overnight. And after that a man climbs into the stone pot and, with his feet, works the lac against the sides to crush out the animal dye. The end product of this operation is grain lac or seed lac, which looks very much like grape nuts.

This seed lac is then stuffed into narrow, stocking-shaped cotton bags some 30 to 40 feet long. The end of the bag is fastened to the wall. The other end is swung back and forth over a low charcoal fire until the lac begins to melt. And as the worker twists the far end of the bag, the molten resin filters through the mesh and drips on the hearth. These hot drippings are rolled into a sheet about two feet square. Then another workman, using his hands, feet, and teeth, stretches the sheet until it is about four or five feet square and proportionately thinner. When these sheets become cool and brittle, they are broken into fragments about the size of cornflakes. In appearance they look like peanut brittle without the peanuts.

The purest of this drip is puddled into cakes about the size of a silver dollar, stamped with an identifying seal, and sold to the electrical industry as "button lac." The bulk of U. S. imports, however, are in the flake form known to the trade as TN or "truly native." At this stage it ranges in color from "ruby" to "blonde." White shellac, as we know it, has been bleached with chlorine, and all shellac reaches American importers' shores as a solid. It isn't until the flakes have been dissolved in alcohol or some suitable caustic that the substance becomes the liquid with which we are all familiar.

Although a very old business in the United States, there are not many more than a dozen concerns engaged in importing shellac.

Highly speculative because of the drastic influence of weather on crops and the lack of control in primitive production methods, U. S. import prices have fluctuated all the way from a low of 7 cents a pound to a high of $1.50 in the past 15 years.

Practically all imports come from Calcutta, where dealers, combing the interior, round up their stocks from individual growers or from local bazaars. Today most of the purchases are made straight across the counter. But there still prevails an ancient and unique custom known as the "secret auction."

In these negotiations the broker, the seller, and the buyers all sit in a circle around a table, each placing his right hand under a cloth in the center. In turn the buyers make their bids by taking hold of the broker's fingers, each finger and each joint representing a specific figure.

Thus, if current prices are in the neighborhood of 40 rupees a maund, the offer is conveyed by two handclasps. The first will indicate the tens, each separate finger grasped representing ten rupees. At the second grasp, each finger joint represents one rupee. Thus if a buyer wishes to bid 35 rupees, he will take hold of the first three fingers of the broker's hand to indicate 30; then the entire first finger (three joints to indicate three; then two joints of the second finger to fill out the five.

The bids are then conveyed to the seller by the broker. If the latter accepts, the broker whips away the cloth and tosses a handful of lac into the lap of the successful bidder.

Repellent Aids in Growing Sweet Potatoes

Growing sweet potatoes and peas in certain sections of Texas has been difficult during the last 10 years because of the ravaging of wild deer. The Texas Game, Fish and Oyster Commission has tested a new chemical deer repellent, Good-rite z.i.p., manufactured by B. F. Goodrich Chemical Company, Cleveland, Ohio, on these crops and has found it very satisfactory.

In Altair, Colorado County, Texas, the chemical formulation was sprayed on peas, peanuts, beans, sweet potatoes and watermelons. According to the agricultural agent in that region, after one treatment of Good-rite z.i.p. the deer were discouraged from doing any more damage to these crops. Comparable results on peas and sweet potatoes were also obtained in other Colorado County communities. One farmer commented that as a result of spraying with Good-rite z.i.p. it was possible to harvest sweet potatoes and peas for the first time in 10 years.

—B. F. Goodrich Chemical Company

Preventable Waste

Condensed from Western Livestock Journal

In 1947 there were enough animals dead on arrival at markets in this country to fill a train nine miles long. Add to this the losses on crippled animals and from bruises, and the producer finds himself bearing the major share of an indirect total loss of $25,000,000 in a single year!

This huge annual loss has been termed "preventable waste" by such industry leaders as H. R. Smith, general manager of the National Live Stock Loss Prevention Board since its formation in 1934. Smith, who has devoted more than three decades to the elimination of waste in the marketing of livestock, points out that the producer is the heaviest loser when he gambles with improper handling, loading or shipping methods.

Daily at all markets large numbers of dead animals are dumped on the unloading docks, victims of improper care and lack of foresight. Scores of cripples are loaded on carts and hauled away for salvage.. Such crippled and dead animals accounted for a national loss of $6,000,000 in 1947.

The closer an animal gets to processing the greater is the cost of any loss or wastage. The producer stands to lose his time and feed, transportation and hauling costs. Such losses were trebled in a three-year period prior to this year. A survey of 25 markets in 1947 revealed a total waste of 3,-694,200 lb. of both dead and crippled animals arriving by rail and 6, 343,200 lb. loss on "crips and deads" arriving by truck at 20 markets.

Preparations for safe marketing begin on the farm or in the feedlot. Mineral deficiencies, particularly calcium, not only retard gains but also cause weakness of bone structure; such animals are more likely to be crippled in transit. Hogs fattened exclusively on corn, which has a low mineral content, frequently break down. Tankage or milk in swine rations supplies calcium. The same is true of legume hays or alfalfa, but if neither is available, animals should have free access to a mixture consisting of equal parts of powdered limestone, steamed bonemeal and salt.

Feeding prior to shipment should be carefully checked. Cattle and sheep fed liberal quantities of alfalfa before loading will have scours and excessive urination in transit. The heart and lungs of fat hogs are so crowded that extra gorging before train-

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Union Stock Yards, Los Angeles, Calif., September 15, 1949

time (within 12 hours of loading) may cause suffocation. Horned cattle in a truck or car cause unnecessary and serious bruising. Cattle should be dehorned in feedlots; or, horns can be easily removed with clippers when calves become of age. Use of caustic on horn buttons will prevent their growth.

Overcrowding in railroad cars or trucks causes more losses perhaps than any other single factor. Most railroads have tables showing the number of animals at a certain weight which can be loaded safely in cars.

Truckers sometimes overcrowd in order to get a better paying load. Too many animals in either railroad car or truck will result in many dead, crippled and bruised livestock arriving at market. Partitions are most important, particularly when mixed loads are shipped. Railroads have tariff regulations requiring them, but truckers, unfortunately, do not. Mixed loads of cattle, hogs and sheep, even horses, in trucks without partitions are not uncommon. A recent survey of 100 trucks arriving at market with mixed loads revealed that 84% had no partitions.

Partitions should be strong—with no splintered boards, protruding nails or poles. Bull boards should not be left in stock cars loaded with sheep or hogs, as the dangling bars may cause crippling or bruising. Proper bedding in stock cars or trucks will eliminate many losses. Purdue station has found that a one-inch depth of sand will cut shipping losses 50%. Cinder bedding for hogs is unsatisfactory, because hogs will eat them, causing injury to casings and intestines.

Straw bedding generates so much heat in summer that it should be used only in winter, but, even then, it should be put over a layer of sand. In winter, stock cars should be papered with strong "elephant hide" paper or slatted up high enough to prevent driving winter winds from striking animals. Such precautions must be particularly provided for recently sheared sheep. In hot weather, hogs should be showered and iced, but drenching cattle or lambs is not advisable. About 200 lb. of ice distributed in the hog car will prevent much loss from overheating. A hog with a wet belly is a live hog all the way to market.

Railroads and truckers are constantly on the alert for improved methods and ideas which will eliminate shipping losses. For example, Union Pacific's solution to reducing losses has been designing new types of live stock cars. These cars are equipped with roller bearings, high speed wheels, automatic brakes and bolster snubbers to reduce vibration and bounce. New type friction gears

eliminate most of the jerk in starting or stopping or when braking down the speed on the train.

In addition, these cars are painted—both ends and roofs—with aluminum paint which deflects the sun's heat rather than absorbs it. Thermo engineers estimate that this practice alone reduces the interior temperature of the car by 5 to 10 degrees. Innovations in new double deck live stock cars include an upper deck 19 inches higher than in standard cars.

Importance of truck shipments is emphasized by the fact that 80% of market-bound live stock is transported by truck. Producers who ship by truck should also keep in mind that each year, except for the war years, that the percentage of cattle dead on arrival by truck has been much higher than by rail. This calls for extra precautions both at loading and unloading points, and a safe careful driver in transit.

Calf losses are also higher by truck. Hog deads have averaged more than twice as high in trucks, but crippling has been less. Sheep deads average four times as high and cripples three times as high in trucks as in rail shipments. In 1947, cattle dead by truck was 60% higher than by rail, calves and hogs twice as high, and sheep more than four times as high. Of course, high truck losses can not be attributed solely to the trucker, but the human element does enter into the picture.

Trucks have road corners, sharper curves, and hills, which with fast driving, cause injuries. Some drivers, to get greater tonnage, frequently overload. Once an animal falls down in a crowded truck it is difficult to regain its footing; trampling, bruises and often death result.

Good loading chutes, not too steep, and placed flush against the rear of the truck will prevent loading losses. Cleated inclines should be provided for unloading from upper decks. Animals forced to jump to the truck floor, or which are pulled from the upper deck and allowed to drop are often severely bruised.

Most stock yards have instructed handlers not to use clubs or canes but canvas slappers when unloading livestock. This has eliminated much rough handling. In recent years the electric prod has found popularity among stockmen. If properly used, it will result in no ill effects, but some cattle hides have been observed to have as many as 25 to 50 prod-damaged areas. This is inhumane and unnecessary. And, there is real danger in "home-made" shockers —both to man and beast. These contraptions are potential killers and should not be allowed by producers interested in their livestock.

Everyone loses when dead, crippled or bruised livestock arrives at market. But the greatest loss is absorbed by the producer. His livestock insurance is calculated upon the basis that there may be such a loss, and the producer pays the premium. Bruises are not easily discerned until after slaughter, but livestock buyers have sharp memories and they pay less next time in anticipation of such losses.

PREVENT COSTLY WASTE, TAKE THESE PRE-CAUTIONS*

1. Dehorn cattle, preferably when young.
2. Remove projecting nails, splinters and broken boards in feed racks and fences.
3. Keep out of feed lots old machinery, trash, and any obstacles that may bruise.
4. Do not feed grain heavily just prior to loading.
5. Use good loading chutes, not too steep. (Blueprints free on request).
6. Bed with sand, free from stones, to prevent slipping.
7. Cover sand with straw in cold weather, but no straw for hogs in hot weather.
8. Wet sand bedding in summer before loading hogs, and while enroute. Drench when necessary.
9. Partition packing sows from light weight butchers.
10. Provide covers for trucks from sun in summer and cold in winter.
11. Always partition mixed loads to separate classes, and calves from cattle.
12. Have upper deck of truck high enough to prevent back bruises on calves below.
13. Remove protuding nails or bolts or any sharp objects in truck or car.
14. Load slowly to prevent crowding against sharp corners, and to avoid excitement. Do not overload.
15. Use canvas slappers instead of clubs or canes.
16. Tie all bulls in truck or car, and partition boars, stags, and cripples.
17. Bull board should be in position and secured before car door is closed on cattle loaded.
18. Drive carefully. Slow down on sharp turns and avoid sudden stops.
19. Inspect load enroute to prevent trampling of downer cattle.
20. Back truck slowly and squarely against unloading dock.
21. Unload slowly. Don't drop animals from upper to lower deck; use cleated inclines.
22. Never lift sheep by the wool.

* Suggestions of the National Livestock Loss Prevention Board, Livestock Exchange Building, Chicago, Ill.

Self-Feeding Brood Sows

Condensed from The Dakota Farmer

Earle W. Klosterman
Associate Nutritionist, N. D. Agr. Exp. Station

THE PRACTICE of self-feeding mixed rations to brood sows has become more popular during recent years. There are some good reasons for this, but there are also a number of important points that must be remembered when this system of feeding is used.

One of the greatest advantages in self-feeding is a considerable saving in labor. A large amount of feed can be mixed and fed at one time. How often the feeders will need to be filled will, of course, depend upon the size of the feeder and the number of sows being fed. Once the feeder is filled all that is needed is a daily check of the sows to see that they are all doing well. No night and morning feeding is required.

Sows that are self-fed are likely to receive better rations than the average ration that is being hand-fed. The reason for this is that if the feed mixture is going to be at all satisfactory for self-feeding it must contain considerable amounts of ground, high-quality alfalfa hay.

Why must self-fed mixtures contain this amount of ground alfalfa? Brood sows have great appetites and, unless the ration contains a sufficient amount of bulk, they will eat more than they should and will become excessively fat. This has been the greatest problem in allowing sows free access to a self-feeder. This question of how to self-feed sows, but still keep them in the right condition, has been answered mainly by the use of ground alfalfa hay.

The amount of ground alfalfa that should be mixed in the feed depends upon two main factors. First, the amount will be determined by the age of the sow. Gilts or young sows are still growing and need more feed than mature sows. Thus, less alfalfa should be mixed with their feed. Secondly, the amount of alfalfa used will depend upon the condition of the sows. If they are not making the gains they should, less alfalfa should be included. On the other hand, if they are getting too fat it should be increased.

It is fortunate that alfalfa hay is used to increase the bulk of a feed mixture to the point that it can be

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Aberdeen, S. D., March 19, 1949

self-fed because high-quality alfalfa has a special value in rations for brood sows. This value can be illustrated best by some results obtained in an experiment conducted at the University of Illinois. In this experiment a ration, that contained plenty of the right kind of protein, minerals, and vitamins A and D, was fed to a group of pregnant sows. A similar group of sows were fed the same ration to which 12% of alfalfa meal was added. The sows were fed these rations during pregnancy, but after farrowing all sows were fed the same ration. The sows fed the ration without alfalfa gave birth to small, weak pigs and weaned only 7% of their pigs in one experiment and 13% in another. The sows fed the ration with alfalfa meal added, gave birth to stronger pigs and weaned 82 and 83% of their pigs in the two experiments. This difference in number of pigs weaned would mean the difference between a good profit or a heavy loss.

How much alfalfa hay can be fed to pregnant sows? Studies at the Nebraska and Pennsylvania experiment stations indicate that mature sows will produce good, strong pigs when fed nothing but high-quality alfalfa hay. Feeding sows on alfalfa hay alone is not recommended, except in the case of dire necessity, since the sows did lose weight on such a ration. It does show, however, that there is no harm in including sufficient alfalfa in the self-fed ration to control the gain and condition of the sows.

There is no one best ration for any class of stock. Many combinations of feeds may be satisfactory. The same is true of rations for self-feeding brood sows, if at least some of two different feeds are included. One of these feeds, alfalfa hay, has already been mentioned; the other is some animal protein such as tankage or meat scraps.

The general livestock feeder has been hearing recently about the amino acids. They are not something new or mysterious; they have been known by the scientist for a good many years. They are really the building stones or parts of the proteins. There are some 20-odd amino acids. They are combined in different kinds and amounts to form the proteins, much as we put letters together to form words. All natural feeds contain amino acids. The high-protein feeds naturally contain more of them. The pig needs certain of these amino acids just as it needs certain vitamins and minerals. That is why a ration for brood sows should contain some animal protein feed. Since these feeds are obtained from animal tissues you would expect them to contain the right amino acids.

In addition to the right kind of protein—tankage and meat scraps

are also good sources of calcium and phosphorus. They are the two minerals that are needed in the largest amounts by the animal body.

One ration that has been self-fed to brood sows very satisfactorily is one-half corn, one-fourth ground oats, and one-fourth ground alfalfa hay with 8% of tankage included. Another ration that has been used successfully is equal parts, by weight, of ground oats, alfalfa hay, and corn with 7% of protein supplement made up of equal parts tankage and soybean oil meal. Iodized salt should also be fed with these rations. The birth of hairless pigs is due to a lack of iodine in the feed and can be prevented merely by using iodized salt.

It should be remembered that the amount of alfalfa given in these rations may need to be changed, depending upon the condition of the sows. It is also necessary that the alfalfa be of high quality and be ground finely enough so that it will work down in the feeder.

Self-feeding does require some equipment. If sows are to be self-fed satisfactorily they must be fed a mixed ration. This requires that the feeds be ground and mixed. If this equipment is not available, or if only a few sows are being fed, it may be desirable to hand-feed them the amount of concentrates they should have and feed long alfalfa hay in a rack. If a number of sows are fed, self-feeding is one way to reduce the amount of labor. If the proper feeds are mixed in the right amounts excellent results will be obtained.

Insects Are Different

Condensed from Better Farming Methods

Dr. L. Haseman
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It is a well known fact that in a new agricultural region, insect pests are seldom a serious problem. This holds true for fruit growing, gardening, general farming and livestock farming.

However, as years go by and farming becomes more intense, insect problems grow in importance. In the past, entomologists have explained this by simply saying that as the acreage of certain crops increases and new pests are brought in and old ones are given

Reprinted by permission from Better Farming Methods
Mount Morris, Illinois, October 1949

time to build up, we just naturally must expect more trouble with our insect foes.

On the surface, this would seem to be a good explanation, and most workers have accepted it as gospel truth. However, some of us here at the Missouri Agricultural Experiment Station have for years been wondering if it is a mere coincidence that as agriculture in a region ages, our insect problems increase.

As the level of soil fertility is lowered, the abundance of certain insect pests increases. This thing has continued to occur repeatedly in the farming areas of America. We have asked ourselves, why should this be so? We have set about to try and find out if there may not be some good reasons why insect pests increase as soil fertility and crop yields decrease.

Investigations under way at the Missouri Agricultural Experiment Station show clearly that some insects, including some major crop pests, do not require what we think of as a balanced diet. In fact, they may thrive better, live longer, produce more offspring, and these in turn may be more sturdy, when they are given a diet, which to our ordinary way of thinking is a very unbalanced one. Take, for instance, the chinch bug, one of our more important grain and grass crop pests. It clearly calls for a high carbohydrate diet and one low in nitrogen and proteins. To it, a diet high in nitrogen is poisonous. It is a sap feeder on grains and grasses and cannot and will not feed on the sap of legumes. Even in case of its diet of corn sap, it thrives best when that contains a minimum of nitrogen. In nature it breeds most upon the eroded clay slopes and seldom is found down in the low places where the eroded upland fertility collects.

In laboratory breeding experiments, P. C. Stone, of the Entomology Department, has found that the chinch bugs preferred and thrived best on corn grown on low levels of nitrogen. When fed on corn grown on high levels of nitrogen he has had trouble keeping the bugs alive and producing offspring. Here we have an insect pest which down through the years has adjusted its nutritional needs and power to reproduce to a carbohydrate diet low in proteins or nitrogen.

In nature, as all observing farmers will testify, it normally finds such a diet dished up to it in best form in the sap of corn or small grains upon the eroded slopes, and preferably in dry summers when soil minerals, including nitrogen, are least available to the crop. We formerly claimed that wet weather and extra moisture down at the bottom of the slopes was what checked chinch bug development. Now we realize that it is the added amount of

nitrogen in crops in good growing years and down in the rich bottoms where the stand of corn is heavy and growth vigorous.

The same thing holds true for some other insect pests, such as the greenhouse thrips. Given an opportunity to choose its food plants from a series of plantings of New Zealand spinach, grown on varying levels of nitrogen and lime with the other nutrient elements constant, it confined its feeding almost 100 percent to those pots of plants on low nitrogen-calcium levels. Here we provided the insect with self-feeders, so to speak. Unlike the hog, which will balance its ration, the thrips chose to feed on the stunted plants which any gardener would never have thought of cutting for the market, though they did carry a higher vitamin content. Insects surely are different in matters of diet, and observations like these pose two questions:

1. Is it possible that insects have learned something about the question of diet which we do not know? Anyway, insects give us something to think about.

2. As pointed out, some of our insect pests do live better on what to us would be considered unbalanced diets. In the race to get rich and to pull from the soil every dime's worth of soil nutrition in the form of crops and meat, are we not actually making for insects a real bug heaven on earth? It certainly looks that way.

As agriculture grows old in a country, and erosion and soil depletion continue, insect pests tend to get worse. True, some pests, like corn borers and plant lice, want and do best on rich, proteinaceous diets. However, some of these cannot utilize the sugars and other carbohydrate elements in the diet. Man-made agriculture in this country in the last 150 years seems to have been shaping our once fertile plains and forests as real gardens of Eden for our insect foes.

If this be true, then we are confronted with a third question: May we not, through sound soil conservation and soil rebuilding, so curb future insect losses that we may dispense with much of our present, ever-expanding chemical warfare against insects? At the same time, won't we be able to produce more and better food for man and beasts and be in a position to fully assure the consuming public that all foods are 100 percent free of any insecticide adulteration?

Barberry Eradication To Control Stem Rust

Condensed from Western Farm Life

F. Herbert Gates

Head, Colorado Bureau of Plant and Insect Control

FARMERS can make an important contribution to reduction of stem rust damage to small grains. It is profitable to grain growers and their neighbors to (1) make sure no susceptible barberry bushes are growing on their farms or in the vicinity, (2) use varieties of small grain recommended by the state experiment station which are the most resistant to stem rust, (3) seed spring grains on well-prepared soil, (4) use the most rust-resistant varieties when replanting, and (5) do fall seeding as near the recommended planting date as conditions will permit.

Weather by itself does not cause rust. Yet there is a direct relationship between weather and the development of rust. Rust spores can thrive only when weather conditions favor their growth, but the spores must be present to cause infection. Moist warm weather merely favors the growth and spread of the organism.

Stem rust has two sources—susceptible barberry bushes and rust spores blown in from other areas.

One stage of rust fungus lives through the winter on old straw and wild grasses. In the spring it produces tiny spores which infect only the leaves on the common or native barberry. The next stage which develops on the barberry leaves, produces the millions of spores which are carried by air currents in dust-like particles and deposited on the leaves and stems of grains and many of the wild grasses. There the common red rust stage of the fungus develops. Millions of the red spores are produced every few days. As the grain matures, red rust spores are replaced by black spores which remain dormant through the winter on the old straw and grasses, completing the life cycle of the fungus.

Under certain conditions, rusted grain in Texas and northern Mexico serves as a source of stem rust on grain crops in the northern states. The red spore stage of the fungus is capable of surviving the winters in the mild climates of the South. Some years, when moisture and temperature conditions are favorable, billions of spores are produced. They are swept northward hundreds of miles by the

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Denver, Colorado, June 15, 1949

wind or drift with air currents to settle on the growing grain. Generally speaking, this northward spread of rust usually reaches eastern Colorado when the grain has sufficiently matured to escape rust damage. However, fields of late-maturing and susceptible varieties are often damaged with the rust blown in from other areas.

Just as there are many varieties of wheat, there are likewise many strains of stem rust. Certain varieties of grain are highly resistant to a number of the strains but very susceptible to others. New strains of stem rust are produced when two existing ones cross during the early stages of development on barberry leaves.

There are approximately 200 different strains of stem rust which attack wheat, 13 which attack oats and 14 which attack rye. Some of the wheat and rye races also attack barley. The existence of many strains of stem rust explains why a small grain variety may be resistant in one locality and heavily infested in another region.

Japanese barberry and its varieties are immune to attack by the stem rust fungus and may be grown where desired without danger to grain crops.

Digging barberry is impractical because any small portion of the root left in the ground will sprout to reform another bush. Chemicals offer the best means of destroying barberry. Common salt applied at the rate of 10 pounds per square foot of crown is satisfactory. Ammate distributed at the ground level to cut-over canes at the rate of 7 to 10 ounces per bush also gives good results.

Neither the salt nor ammate should be used where there is a possibility of harming nearby plants. In this case, 40 percent 2,4-D applied to cut-over canes will kill the bushes without injury to other plants. Native barberry in Colorado is eradicated by spraying with 2,4-D during the growing season and with chlorate the remainder of year.

Colorado is one of 18 states actively engaged with the United States department of agriculture in a cooperative effort to destroy all rust-spreading barberry bushes. More than 20,000,000 bushes have been destroyed on about 3000 properties within the state. Eradication remaining in 30 counties constitute rework of infested areas together with some initial treatment in the southwestern Colorado counties.

Hog Growers Debate

Condensed from Capper's Farmer

George A. Montgomery

Pro Pavement

SIXTEEN tons of pork a year are produced on a space 54 by 68 feet, by Frank McNelly. His pigs are born on concrete and remain there until they go to the packer. McNelly began to raise pigs in confinement because his building site is on a corner of the farm he operates in Houston county, Minnesota. Any pasture rotation system he could devise would force daily trips to the fields to do hog chores.

After using paved quarters several years he likes the idea for other reasons: (1) It effectively controls parasites and disease; (2) more pigs are saved; (3) faster gains are possible; (4) soil erosion is reduced; (5) there is more land for feed production.

"There are disadvantages, too," he said. "A lot of hard work is required to keep floors clean. "If this job is neglected or delayed because of pressure of other work, pigs are wallowing in filth. Confinement rearing shouldn't be recommended to a fellow who is inclined to be careless or who finds it easy to put off disagreeable jobs.

"Tests show more grain and protein feeds are needed to produce a given amount of pork on concrete. That is a drawback, but I can offset it by growing grain on land that would have to be in pasture if I produced pigs in the field. It would take at least 5 acres of legumes for 10 or 12 spring litters. I can produce 375 bushels of corn on 5 acres. It will provide all the extra grain I need, and I believe there will be enough left over to buy the other feed that must be used as pasture substitute."

Worm trouble turned Anton Gensmer to concreted hog lots in 1934. Experience with his first pig crop on the slab convinced him it was the only way to cut losses from soil-borne diseases and parasites. When I visited him in Winona county, Minnesota, he had 6 litters of spring pigs about ready for market.

"Forty-eight pigs were born alive," he said. "I still have every one. You can't save 100 percent when you raise them on the ground. There are no runts, no signs of parasites. I never bother about worming any more. When pigs are 5 months 3 weeks old,

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Topeka, Kansas. November 1949

they're ready to go. They weigh 215 to 225—sometimes up to 230 pounds."

D. W. Marsau and Son raise around 30 litters a year in Black Hawk county, Iowa. Spring pigs spend all their lives on concrete, but some fall litters are born in the field. Occasionally the Marsaus have equaled Gensmer's record of maturing every pig born. Once they sold every one of 107 pigs born in 11 litters. At another time 15 sows farrowed 167 pigs and 158 went to market. The 9 pigs lost were trampled or overlaid before they were a week old.

Grant Lapham, McNelly's neighbor in Houston county, Minnesota, took over the farm that had been his grandfather's. Fences were in bad repair and starting a swine project appeared costly.

"Why not rear them on concrete?" an extension man asked. Lapham started with paved lots and a barn with concrete floor. Three weeks later he got cold feet. He couldn't believe a pig could be thrifty unless he could get his nose into the dirt. He turned all sows and litters into a clean field. They broke thru the fence, ranged on land where hogs had been raised the previous year. Lapham was in plenty of trouble. The next year he penned all litters on concrete and left them there.

He treated for worms. A close watch revealed but 1 or 2. He had the thriftiest pigs he had ever raised. He has continued confinement rearing. The only time his pigs get a taste of dirt is during the first few weeks when he gives them clean sod to provide the minerals needed to avoid anemia.

The Marsaus use fall gilts as brood sows. Some of those they hold back are born on clean pasture, but they are put on concrete before weather turns cold. Some go to the fields to farrow the first litter, but others remain on the slab until they are sold after the second litter is weaned. Plenty of big husky pigs are produced. Sows, during pregnancy, get a ration of 30 pounds alfalfa, 20 pounds corn, 40 of ground oats and 10 of protein. During the last 60 days of gestation protein is increased to give gilts ½ pound apiece daily, sows ¼ pound.

The Marsau nursing ration for sows contains 50 pounds corn, 30 of oats, 100 of alfalfa and 10 of a protein mixture composed of 2 parts tankage and 1 each of soybean and linseed meal. Pigs get a similar ration until they weigh 100 pounds.

New insecticides have proved a big help to those who raise hogs in floored quarters. Marsau and Gensmer spray regularly with DDT. The Marsaus never use anything but dry feed. However, manure attracted flies that were never adequately controlled until the new chemical was available.

Gensmer paints shed interiors with a preparation that contains DDT. Flies are scarce at his place because all resting places are treated.

The Marsaus figure that there is no other work on the farm more important than keeping swine quarters clean. They consider manure piles in the pen about as bad as mudholes in a dirt lot. They scrape floors and wash waterers at a regular time each day. Nothing else is permitted to interfere with these jobs.

Pro Pasture

A NEW WAY to cut pork production costs was introduced in Woodford county, Illinois, in 1920, the year Arthur Engel started to farm. Extension work that reached out to barn lots and cornfields was young and husky then. Hog producers and their new hired man, the farm adviser, took hold of the idea, the McLean county system of hog lot sanitation, and put it on Woodford county farms to stay. Engel was one of the first cooperators. He never has raised hogs any other way.

I found him in a big green alfalfa field, caring for 33 fall litters. Sow cots dotted the meadow. Near each was a red-white-black spotted gilt and her litter of speckled pigs. The sows were held near houses by low electric fences. They browsed young legumes while pigs soaked up afternoon sunshine in a coolish fall atmosphere.

Hog diseases and worm eggs may be carried from one farm to another on shoe leather, so I waited at the field entrance while Engel cleaned waterers and put out feed for the last half-dozen sows.

He stopped his truck at the gate. We talked about McNelly, Gensmer, the Marsaus, Lapham, and their way of raising hogs on concrete.

"A man has to fit a hog project to his own farm and the way he likes to do things," Engel said. "My crop pattern and hog lot rotation go together. I need legumes to keep up the land. Hogs provide a good market for part of the forage the crop provides. Green pasture cuts costs, and I don't believe you can make pork any place else as cheaply as on an alfalfa field.

"Hog manure is a rich fertilizer. I want it scattered on the fields that grow my feed. When hogs do the spreading all the plant food it contains is saved. I would rather haul out grain and protein than to haul manure. It is a cleaner job. I wouldn't want to scrape manure off floors each day. I have raised up to 74 spring litters. It would be a big job to keep quarters sanitary for that many.

"The McLean county system does a good job of controlling

worms and disease. My pigs are reared on ground that hogs haven't occupied for 3 years or more. I vaccinate to avoid cholera. I count on clean ground to keep me free of other troubles. I have had only one outbreak of disease —a touch of erysipelas in 1931. I never worm pigs because there seems to be no need. I get by with 3 percent runts. Most of them are pigs that didn't get a fair chance during the nursing period. They gain in thrift after they are weaned and all finish within 2 weeks after the youngest litters go to market."

Willard Eiler, who raises 500 hogs a year in Cedar county, Iowa, went back to pasture after giving the pavement method a careful trial. Two big objections to the floored-lot system were stench from the manure and the extra labor required.

"We cleaned the slab daily, loaded manure directly into the spreader, hauled it to the field promptly, but we couldn't keep odors under control," Eiler said. "One man spent 4 to 5 hours a day caring for 150 fall pigs. Most of that time was needed to clean floors and spread manure. We have 330 pigs on pasture now, and they require only 1 hour a day, despite the fact we must haul both feed and water."

Pech Brothers, who use the clean pasture system in Buchanan county, Iowa, hold pig losses as low as 2 percent. One spring 17 sows farrowed 163 live pigs. The Pechs sold 160 of them. Average weight was 252 pounds at 170 days. It keeps anybody stepping to produce more than 20 tons of pork from 17 litters in less than 6 months. These Iowa hog men, who have been winners in the state pork production contest, doubt that such gains can be made anywhere except on good clean pasture.

Mud and filth are the media in which pig troubles incubate. The Pechs plan their farming operations to keep their soil fluffy and porous. All fields are well tiled and water soaks away within a few minutes after the hardest rain. Pigs never have a chance to develop a wallow as a breeding place for disease. Pech pigs follow a 5-year crop rotation. That means litters are raised on fields that have been free of swine 4 full years.

"Good pasture is the best feed balancer a man can use," one of the Pechs told me. "It cuts down protein bills and reduces amount of grain needed for each unit of gain. Our litters always are as large as the dams can suckle. One fall the smallest litter contained 11 live pigs, the largest 16. Good pasture deserves a lot of credit for these big litters—and for thrift of the growing pigs."

After raising hogs on concrete several years, L. E. Hanson, Ne-

braska Experiment Station, agrees the job is simpler when litters are raised on pasture.

"It is easy to make costly errors on concrete," he said. "The most ticklish job is to keep the ration right. Either sows or pigs may lose appetite and go off feed. We have found no way to prevent this. We use the best ration we can concoct. It contains 10 percent of good alfalfa meal and 5 percent distiller's solubles to provide needed vitamins. Yet, sows we have kept on floors never have milked well. Weaning weight of pigs ranges from 15 to 20 pounds. Growth is satisfactory after they reach 35 pounds, but it takes too long to get them there.

"You can't throw feed into the trough and forget the herd until the next feeding. You must keep an eye out constantly for trouble. If a sow doesn't step up and eat heartily, feed must be withheld until she's hungry again. Then you must bring her back slowly to a full ration. It is a job for a careful hog man. We haven't yet learned how to make it safe for the fellow who wants to drift along the easy way."

Iowa Experiment Station farrowed 8 late spring litters on concrete. Half the sows and their pigs were moved to alfalfa when the pigs were 4 days old. The other litters were grown out where they were born. Both groups were fed grain and protein supplement free choice. Pigs on pasture averaged 48 pounds when they were weaned at 56 days and they reached 225 pounds 103 days later. The paved-lot pigs were 8 pounds lighter at weaning and took 18 days longer to reach 225 pounds. Each pig raised on concrete ate 102 pounds more feed—and most of it was high-priced protein.

Reports On Automatic Feeding

Condensed from Poultry Tribune

Bentley Wilson

With the gradual application of mechanics to specialized poultry raising, it was inevitable that an automatic feeder would be developed.

Within the last two years such feeders have been designed, built, perfected, and now are being manufactured for sale

No one individual can be given

Reprinted by permission from Poultry Tribune
Mount Morris, Illinois, November 1949

credit for the refinement and development of mechanical feeders. However, Pennsylvania State College was among the first of the state experimental stations to develop a feeder that worked.

At almost the same time, several manufacturers made mechanical feeders available to poultry raisers.

After examining mechanical feeders that are being offered for sale today, the first question asked usually is, "Are there any advantages in mechanical feeding?"

G. O. Bressler, Department of Poultry Husbandry, Pennsylvania State College, has had an opportunity to observe and study flocks being mechanically fed with the Pennsylvaina type of feeder. He states that there is a saving in time and feed.

In addition, he lists other advantages of mechanical feeding that must be considered. They are: (1) It eliminates trips to the poultry house for feeding mash and supplementary feeds; (2) reduces amount of feeding space necessary when compared with hand feeding; (4) makes possible an increase in the size of the flock or brood that can be handled by one man; (5) provides time so that the poultryman can pay more attention to other poultry practices that frequently were neglected while hand feeding.

Bressler adds further that considering all of these factors, it is reasonable to believe that automatic feeders will find a definite place in the efficient production of poultry meat and eggs.

What have the results been when mechanical feeders were used? At Pennsylvania State College, in comparing the hand feeding of layers with mechanical feeding (using the Pennsylvania State designed feeder), some practical advantages were demonstrated. Four pens of 98 layers each were compared. Two were hand-fed pens and two mechanically-fed pens.

The layers fed mechanically received mash once every hour throughout a 13-hour day.

Layers in the two hand-fed pens were fed mash and scratch once a day for the first eight weeks of the test. At the beginning of the ninth week, four pounds of pellets were fed daily to each pen of the hand fed layers, in addition to mash and scratch.

At the beginning of the twenty-seventh week, condensed buttermilk was fed in addition to the pellets, mash, and grain. During the 30 weeks of the experiment, the mechanically fed layers received only mash and scratch grain.

In spite of the extra feeding and work carried on in the hand-fed pen, feed consumption in all pens was practically the same.

Feed consumption was compared on the basis of pounds of feed required to produce a dozen eggs, and it was found that the mechanically-fed layers required 0.5 to 1.2 pounds less feed than the hand-fed layers.

This feed saving was attributed to less waste in the mechanically-fed pen. During the 30 weeks that the test was conducted, egg production was practically identical, although there seemed to be a slight advantage in favor of feeding the layers mechanically. On the whole, in comparing the several pens, the Pennsylvania investigators found no significant difference between the hand-fed and the mechanically-fed layers.

While the use of mechanical feeders for layers is quite promising, perhaps the greatest use of mechanical feeders so far has been by broiler producers.

One broiler grower using a 48-ft. Pennsylvania State automatic feeder, and feeding 1,500 birds, saved an average of one hour daily over a 13½ week period. There also was a saving of five percent in feed wastage.

Another broiler producer located in a commercial broiler area using a manufactured feeder reports a saving of two hours labor per day and a saving of two to three tons of feed on each 10,000 broilers.

The new feeders being manufactured are so built that they can be adapted to almost any type of poultry. Installations are being placed in turkey houses for growing poults, also on open ranges for growing chickens.

Features of the new feeders include large feed supply drums, development of trouble-free power and gear units, and heavier and more substantial feed troughs.

Feeders can be purchased at present for almost any sized poultry operation. The type of trough produced is of such a design that various layouts can be made in the poultry building to secure the amount of trough space needed for the flock or brood. They may be installed with one or two lines of troughs.

Manufacturers rate their largest models as being capable of feeding 6,000 to 12,000 broilers; 1,500 to 3,000 layers, and 3,000 to 6,000 poults.

Small units are designed to feed 800 to 2,400 broilers; 200 to 600 layers, and 400 to 1,200 poults.

Do You Know?

Potatoes lose as much as two-thirds of their vitamin C during six months of storage after being harvested.

"Your Health"
Medical Society, State of Pennsylvania

The Future of Artificial Breeding

Condensed from Holstein-Friesian World

Dr. J. W. Bartlett
Head, Dairy Dept., Rutgers University

ELEVEN years ago the first Co-operative Artificial Breeding Unit began operations in this country. It had 93 members who owned about 1,000 cows. It was started on a shoe string with enthusiasm mixed with considerable skepticism. Today we are breeding in this country nearly 3 million dairy cows and Artificial Breeding Institutions have become an enormous institution. The program has spread faster than any other idea in the history of dairy farming.

Like every new idea which has spread very rapidly many things have happened more quickly than we could cope with but by and large we have done a good job, as the program was in good hands.

Today Artificial Breeding carries a two fold challenge. First we cannot be satisfied with superior sires but must find methods of creating superiority in germ plasm. Secondly at a time when the farmers' buying power is down we must provide more and more farmers with these greater services at no greater cost.

In New Jersey we are fast reaching a point among those who early adopted the Artificial Breeding plan where average production in their herds is over 450 lbs. of fat. Those farmers are not content to remain at that level. They want sires that will raise the production a notch higher. They have learned a lot about type and they are type conscious to the degree where they demand it. In large areas it will take longer for these demands to arrive but they will come. The future of Artificial Breeding is sound. It's here to stay. It will have improvements. There is economy in volume business and we should have 50 percent of our herds in such a program instead of ten to twenty-five percent as exists today.

From what I have said you will conclude that the answer to successful Artificial Breeding is developing greater superiority in our sires and increasing volume of service at no greater cost, whereas to find the great sires is fast becoming a problem in all Cooperatives. It is the greatest problem.

Our local Cooperatives are worried about the commercial organ-

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Laconia, New York, October 15, 1949

ization which will sell service anywhere in this country. It is my opinion that there will be more of them. There will be some private institutions which will offer services to greatly advertised sires and some dairymen with high producing herds will subscribe to such a plan.

There will be some of our better farmers whose herds will reach high production and they will become new breeders in their own right. They may help to provide future sires for Cooperatives.

Certain Cooperatives already are faced with management problems. I know of one where the manager rather took many important matters of sire selection into his own hands until his directors put a stop to it. We must not let the personal element get so strong that it dominates a program. On the other hand, I believe that certain Co-ops will become so strong that they will have breeding programs and no doubt will sell semen and probably surplus bulls to other Cooperatives.

Already there are strong possibilities of government supported projects for improvement in animal breeding. They will succeed only in so far as local and state communities support them and use the services offered. There are great possibilities in such projects. They will be in competition with our great breeding herds and no doubt will be frowned upon by some people.

Professor Rice is a champion of seeking out families which nick. Selected matings of this kind seem to me to be the answer to the greatest improvement in the near future. Certainly our scientists have not found any better method of predicting. This means that the Cooperative and the Colleges must everlastingly be on the job of research to find the cow families that are available as dams of the future herd sires. If this is done, and it is being done in a small way, Cooperatives may cooperate in breeding programs. It should be done in a big way and the sooner the better.

Purification of certain families for high production has been my own hope for a long time but when we must include type, size, vigor and breeding efficiency along with production, it is a slow process and breeders become impatient. It is possible, however, and with rigid selections offers a method of developing greater sires. The combined effort of Artificial Breeding Co-ops toward providing funds or inducing private or state and government support for study of this problem will be a great step toward more efficient dairying. The lack of breeding efficiency and longevity in our dairy cattle is our greatest millstone today. No one has measured Hybrid

Vigor but we talk a lot about it. I think we shall have to select for vigor rather than creating it. Let's weed out the poor breeder.

One thing lacking in our program so far—and will be until someone finds a sure method of predicting a bull's transmitting ability—is a place to maintain young sires until their worth is known. The Cooperative is the place to prove bulls and it must provide a farming out plan while the bull waits to find out if he is to be promoted or sent to the butcher. We still have too many diseases to loan sires promiscuously. Good bulls are scarce today. Thousands have gone to the butcher as calves that had the inheritance to be great sires. Artificial breeding is a scheme which eliminates the bull. Artificial Breeding must provide a plan of saving what few we select.

Space and care must be provided for the resting of old bulls in service. Research today and in the future is and will find techniques of returning to active service many valuable sires that are temporarily infertile.

Greater advantages must be taken of the possibilities of semen dilution. We have much to learn even now about handling semen. The inheritance of great sires must have greater availability to more dairymen. We can only dream of semen banks but they are a strong possibility.

In a little over ten years we are at the crossroads in a great program. We are faced with problems of genetics, of possible exploitation of a great program, of finding good sires even now, and yet 3 times as many dairymen believe in the idea as have accepted pure breds in a period of sixty years. We have the cooperation of the breed associations, we have the cooperation of our colleges and the government. What we need is better cattle.

Today's Knowledge of Undulant Fever

Condensed from Hygeia Magazine

Dr. Wesley W. Spink

DURING the last century a distinctive type of fever was observed in natives and visitors to the Island of Malta. The fever was accompanied by weakness, sweating, chills, body pains, headache and nervous manifestations. Those affected were often sick for days or weeks, felt reasonably well for an equal period of time and then had another wave of fever. This sequence was repeated many times. The causative germ was discovered in 1886 by Sir Davis Bruce, a British Army Surgeon sent to Malta to study the disease. Because of the significance of his discovery the disease is called brucellosis. Later is was found that the microbes causing this illness, now known as Brucella, reside in the tissues of goats and the disease was transmitted to man by drinking raw goat's milk. The disease was controlled in Malta by the simple expedient of boiling milk used for human consumption.

In 1906 an army nurse in Washington, D. C. had the first recognized case of brucellosis in the United States. Five years later the disease was observed in goats in the southwestern part of this country and human beings were contracting brucellosis from them. For years the goat was believed to be the only domestic animal harboring Brucella, but research showed that a closely related strain of Brucella invaded cattle and a third strain invaded hogs. It is now well established that brucellosis is rarely transmitted from human to human and that the reservoir of the disease is in domestic animals, particularly goats, cattle and hogs. Man acquires the disease chiefly in two ways; first, from the ingestion of raw goat's or cow's milk or milk products such as cheese and butter; second by coming in contact with the tissues and/or the secretions and excretions from infected animals. The microorganisms may enter the human body through small abrasions on the hands.

The disease in animals is not only a menace to human health but also is of serious economic concern to livestock breeders and farmers. In cattle brucellosis is known as contagious abortion or

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Chicago, Illinois, July 1949

Bang's disease, being a common cause of abortions. Brucella also locate and multiply in the cow's udder, and this reduces the production of milk. Since cattle are raised for breeding purposes and the production of milk, brucellosis costs cattlemen millions of dollars a year. Brucellosis also causes abortion in hogs and goats. Animal brucellosis is highly contagious and difficult to stamp out once the stock is infected. Animals in apparent good health may shed the microbes of Brucella in their milk for many months.

Brucellosis is prevalent in rural areas where a considerable segment of the population drinks raw milk. It is also an occupational disease involving farmers and their families, livestock breeders, employees of packing plants and veterinarians. People living in large metropolitan areas where only pasteurized milk is sold are not victims of brucellosis except when they travel and drink unpasteurized milk or milk products. City dwellers also have contracted brucellosis during vacations in the country.

The acute disease in man often mimics influenza with its bodily aches and pains, chills and fever, sweats and weakness. Usually the illness lasts less than three months. Occasionally brucellosis may cause complications such as destructive bone lesions, especially on the spine; abscesses in various organs; inflammation of the heart valves; or involvement of the central nervous system with the resulting encephalitis or meningitis. Brucellosis does not cause abortion in women any more frequently than other bacterial infections. Quite commonly the acute phase of the illness may be relatively mild and the illness may remain unrecognized. A chronic illness may follow, marked by a continued feeling of weakness, low grade fever, mental and physical inertia, vague aches and pains and mental depression. In the chronic state patients may be diagnosed as having pyschoneurosis, neurasthenia or an anxiety state. On the other hand, persons having emotional and functional disturbances have been misdiagnosed as having chronic brucellosis on the basis of inadequate information.

We do not know how many persons become the victims of brucellosis each year in the United States. The lack of knowledge is due in part to the fact that many cases of brucellosis remain unrecognized since the disease is difficult to diagnose accurately. In some parts of the country the disease is being recognized with increasing frequency.

Brucellosis rarely occurs as an epidemic, therefore a sporadic case may be easily overlooked. Many physicians in rural areas are

on the lookout for human cases and do not make the correct diagnosis of persons suffering from an ill-defined illness. The correct diagnosis can be made positively only with the aid of laboratory tests which include blood examinations. The agglutination reaction, performed with blood serum from a suspected case, is a reliable method of diagnosis. The test is similar to the one used in the diagnosis of typhoid fever. The agglutination test is the most dependable method for quickly screening questionable cases of brucellosis. A positive diagnosis is made by isolating the microbes from cultures of blood. A skin test is also widely used for diagnosing brucellosis. A positive skin test for brucellosis shows that at some time the microorganisms of brucellosis have invaded the body. It does not necessarily mean the presence of active disease. One must, therefore, be cautious in diagnosing brucellosis when the skin test is positive but the agglutination test and blood cultures are negative.

Until recently there has been no satisfactory treatment for brucellosis. Fortunately, many patients having the form of the disease have recovered completely without treatment or after a short period in bed. For the chronic cases, a widely prevalent practice has been the periodic injection of killed Brucella or products of these microorganisms under the skin.

By such a procedure, physicians have attempted to desensitize the patients to the Brucella. Under this treatment some patients have improved. But the use of vaccines is a time-consuming procedure. The injections often provoke discomfort and it is doubtful that they actually lead to the eradication of the microbes from the body. The sulfonamide drugs excited enthusiasm at first, but only an occasional case responded in a desirable manner. Penicillin is without effect in brucellosis. The antibiotic, streptomycin, was used hopefully at first but further experience yielded disappointing results. Another development in treatment was a combination of streptomycin and sulfadiazine which appeared to work when the administration of either drug alone failed to help the patients. The combination of drugs has given encouraging results in several clinics. Streptomycin is injected into the muscles four times a day and sulfadiazine is administered by mouth. Treatment with both drugs is kept up for two weeks. This has the disadvantage that patients undergoing treatment must be hospitalized, making it expensive, and undesirable reactions have resulted from streptomycin. The combination of streptomycin and sulfadiazine has controlled the

disease in patients having severe complications. It has shortened the duration of the disease in many patients less seriously ill.

Another advance in treatment has occurred with the introduction of the antibiotic, aureomycin. This drug has the advantage over streptomycin and sulfadiazine in that the patients can take it by mouth and hospitalization is not always necessary. Capsules of the material are given four times a day for two weeks. Aureomycin has always successfully controlled the disease when the combination of streptomycin and sulfadiazine has failed. Aureomycin appears to have only mild side effects such as nausea, vomiting and abdominal distress. It is too early to assess the value of aureomycin completely in the treatment of brucellosis, but the immediate results have been encouraging.

Other drugs are being studied for the treatment of brucellosis. These include chloromycetin, another antibiotic which is also administered by mouth and which apparently causes no serious toxic reactions. It is apparent that the long search for a drug or drugs to control human brucellosis is beginning to bear fruit.

Since brucellosis is rarely transmitted from human to human and the reservoir of the disease is in domestic animals, the elimination of brucelloss as a human disease depends upon eradicating the infection in animals. Serious efforts are now under way to control the disease in cattle by vaccinating calves and by removing infected adults from the herds. The disease in cattle is recognized by a blood agglutination test, a fairly accurate index of activity. The control of brucellosis in hogs is more difficult because the blood test in this species is not so reliable. Because the goat population in this country is not large and the majority are located in the Southwestern states, the disease is no serious threat to human health, except in isolated areas. The eradication of brucellosis in animals will be accomplished through persistent effort and the cooperation of many groups. Just as tuberculosis and tick fever in cattle were controlled, brucellosis will eventually cease to be a menace to human beings. In the meantime, the majority of the population may protect itself by drinking only properly pasteurized milk and eating milk products, such as cheese and ice cream, that are prepared from pasteurized milk. There is no satisfactory way to vaccinate human beings against brucellosis.

Gold From Citrus Waste

Condensed from Chemurgic Digest

J. E. Hutchman

A $500,000 Florida organization grub staked a claim that is now paying off. Back in 1942 when oils were in great demand, attention was directed to the golden colored oil found in citrus seed. Little was known about its possible uses and still less was known about the quantity that could be obtained. There were few records that showed what the seed content of fruit was and even those records later proved to be too optimistic. However, that may have been a blessing in disguise. Otherwise the real value might never have been developed.

The manufacturing and processing steps as well as equipment had to be developed from scratch as there was, and is, no other plant of its kind. It has developed rapidly since it was first tested in the late spring of 1947. Since that time is has expanded until, during the last season, as much as four tank cars of citrus seed oil were produced in a single month.

Citrus seeds, all varieties, form the primary raw material. The prime end product is the seed oil but other by-products are almost of equal importance. One major by-product is the seed meal left after the bulk of oil is removed. This meal is one of the most palatable protein feeds for cattle tested in several years at the Experiment Station at Gainesville, Florida. Here is a rich protein meal which constitutes a feed equal to or better than most feeds now imported into the state. The seed hulls are removed and ground for use as a fertilizer conditioner. At the present time, the seeds are processed into approximately one-third oil, one-half meal, and one-sixth hulls. Plastics, resins and medicinals are produced from the oil.

Much opposition to the removal of seed from cannery waste was encountered at first. Manufacturers of citrus pulp feeds were afraid it would hurt their business by lowering the quality of citrus pulp feeds. Just the opposite has proved to be true. State control tests have shown that citrus pulp feed, made from cannery waste from which seed has been removed, is improved in two ways. First, it is made uniform in composition throughout the season and, secondly, the undesirable fiber content is greatly reduced.

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350 Fifth Avenue, New York 1, N. Y., September 1949

Tests also showed that pulp feed after seed removal showed six per cent protein, more than three per cent fat, and only seven per cent fiber. It is generally recognized that fiber is an undesirable constituent of cattle feed. This is especially true of the harsh citrus seed hull fiber.

Seeds can be removed very cheaply from cannery waste without disturbing handling procedure and disposal of residual peel and rag. Seeds average about three pounds per box in seeded fruit. This seed contains 60% moisture that must be promptly removed not only to reduce load weight but also to keep the oil in the seed from spoiling.

For this purpose the Hutchman Company operates a drying plant at Lakeland, Florida, for the benefit of those canners who do not have drying facilities of their own. The dry seed is then shipped in bulk to the oil mill where the interesting processing begins.

However, before the transformation of the seed to plastics, medicinals, or foods begins, the canning plant needs money. They get it promptly. Immediately on receipt of the dry seed, the canning plants this past year were paid $35 cash per ton and soon thereafter received protein meal and ground hull of approximately equal value. Thus, this '48–'49 season they received approximately $70 per ton of dry seed delivered to the oil mill.

In terms of boxes of fruit, this is equivalent to four and one-third cents per box. That does not sound like much but we can look at it another way. Approximately 5,000 tons of dry seed can be collected in Florida from major canners. At $70 per ton that is a larger figure, $350,000. All this money goes right back to the canners. At the same time, additional raw materials are released as starting points for further profit. This return to the canners is more surprising when one considers that during this period of time the market of vegetable oils became exceedingly weak. Cottonseed oil dropped from 40¢ per pound to less than 9¢ per pound.

Cottonseed oil mills are modernizing themselves by converting from hydraulic presses to expellers. The Hutchman Company tried both hydraulic presses and expellers to get an oil of the highest quality. The expellers were found to be much superior. However, after less than three years operation they have been forced to go through the development steps of another process, solvent extraction. One manufacturer of solvent extraction equipment after another was approached. All said this type meal could not be handled in a solvent extraction plant because it packed, channeled, and would not flake. For-

tunately, a successful process was worked out in conjunction with the present expellers. By the new process, practically all the oil can be recovered as prime oil. The expellers for preliminary crushing of the seed are retained to reduce the oil load on the solvent equipment.

An unexpected advantage of expeller processing also added to the wish to retain this step. It was discovered that in the heat and pressure of the expeller a considerable amount of fiber was converted to a soluble, digestible food.

The expeller cake is ground and conveyed to the extraction system through which it moves in a continuous flow until it emerges as dry, odorless protein meal from one line and as clear golden oil from another: two raw materials for other industries to take up in the forward march of industrial progress in Florida.

Testing Ewes for Lambs and Wool

Condensed from Breeder's Gazette

Graydon Blank
Extension Sheepman, Michigan State College

FARM flocks of sheep are profitable when they get good care. There can be no doubt about this after examining several years of records made by flock owners enrolled in Michigan's annual Lamb Production Project, sponsored by the Michigan State College animal husbandry specialists in cooperation with county agriculutral agents since 1931.

Each year flock owners vie for the title of "Champion Flockmaster." Records made by the winners of this title and their many close competitors not only show that the farm sheep flock is mighty good property to own but also reveal the management practices which successful flock owners follow.

In brief, this project measures the pounds of lamb and wool produced per ewe. Since 1941 production has been figured on the basis of 100 lbs. of ewe weight, in order to give all breeds an equal chance. Ewe weights were taken approximately half way between breeding and lambing time.

One Michigan farmer has been enrolled each year since the beginning of the project with the exception of one war year when

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Spencer, Indiana, October 1949

the project was not conducted. The records of this flock owner—Ralph Densmore of Elwell, Michigan show clearly that selection on a production basis pays big dividends. For two consecutive years Ralph and his sons, Harry, 18, Rex, 16, and Max, 14, were named "Champion Flockmasters."

Their best record was made in 1947 when their 26 grade and purebred Oxford ewes raised 51 lambs to an average weight of 76 lbs. at 4½ months of age. The ewes sheared 8.3 lbs. of wool per head —surely a profitable enterprise.

To raise a crop of lambs like that requires extra attention at lambing time, but such care will pay big dividends for any flock owner. However, it wasn't this alone that enabled the Densmores to make their record.

To begin with, the lambs were sired by an outstanding registered Oxford ram. Legume hay and plenty of exercise helped to condition the ewes properly for lambing. All lambs were docked at an early age and the ram lambs castrated. Phenothiazine and salt fed regularly at the rate of one lb. of Phenothiazine to 14 lbs. of salt, formed the basis for controlling internal parasites, and the flock was dipped to control ticks and lice. Good pasture during the summer was not overlooked either, although for the early part of the season the flock was on permanent June grass pasture.

Densmore ranked first in seven of the nine points on which the high flocks were scored. These points include the number of lambs dropped, the per cent raised of the number dropped, and the lamb and wool weights.

Following the Densmores closely in the 1947 project were Hill Bros., Vermontville, Eaton County, who raised 105 lambs from 62 grade ewes and Shropshire rams. The lambs averaged 77 lbs. at 4½ months, and the ewes sheared slightly over eight lbs. of wool per head. Russell Jones, Cassopolis, Cass County, raised 47 lambs from 32 grade Shropshire ewes, to an average weight of 80 lbs. at 4½ months. His ewes sheared an average of 10.9 lbs. of wool. Twenty-five grade Oxford ewes bred to a registered Suffolk ram raised 37 lambs to an average weight of 91 lbs. at 4½ months, for Pope and Wheeler of Mt. Pleasant. This was the highest average lamb weight recorded for this age. Parasite control and good care increased the shearing average of this flock from 8.6 lbs. in 1946 to 12.2 lbs. in 1947.

Proof that larger flocks can be equally profitable was provided by Earl Pennington & Sons of Britton, Lenawee County. Their 82 grade Shropshire and crossbred ewes raised 106 lambs to an 86-lb. average at 4½ months. These ewes sheared 8.6 lbs. of wool.

Further proof that larger farm flocks can be very profitable was demonstrated by Hill Brothers, Vermontville, champion flock-masters in last year's Michigan project. A flock of 88 grade ewes bred to purebred Shropshire rams returned these brothers an average of over $35 per ewe. The Hill Brothers' ewes dropped 158 lambs and raised 143 of them to an average weight of 74 lbs. at 4½ months of age. This gave them 120 lbs. of lamb per ewe at that age. There were 11 sets of triplets and 48 sets of twins. All but a very few lambs topped the market directly from pasture without receiving any grain.

Production practices in all the high flocks in the Michigan project always follow nearly the same pattern. The use of good purebred rams, care and attention at lambing time, the use of individual lambing pens, docking and castrating at an early age, good pasture and the use of phenothiazine and salt for worm control were among the practices followed in all high flocks.

As an "Achievement Day" for the Lamb Production Project, the owners of the high flocks are invited to exhibit a pen of ewe lambs at the annual Farmers' Week, held at the college in early February. This exhibit has always attracted considerable attention, and shows clearly that farm flocks that are well cared for are profitable. It emphasizes the need to select breeding ewes on the basis of production and the need to constantly cull the poor producers. It shows the results of using good purebred rams, and demonstrates the need for a sound parasite control program. There is no doubt—a farm flock that is well cared for is profitable. The records prove it.

How to Protect Silage From Freezing

Keep surface of silage in freezing weather shaped like an inverted pie plate. That is the best way to hold frozen silage to a minimum, advises Charles F. Rogers, Ohio Experiment Station. Farmers who dig out silage around the wall first, keeping the middle flat and smooth, have the least trouble with frozen feed, according to Rogers.

Freezing doesn't destroy feed value of silage, provided it is used before it spoils after thawing. Silage freezes like water in a bucket, first a ring at the surface, then across and down the sides with the original ring getting thicker.

—Capper's Farmer

Scientific Neglect

Condensed from American Fruit Grower

Dr. R. E. Stephenson
Soils Dept., Oregon State College

NESTLED in a 20-acre area in the famous Hood River Valley of Oregon, with snow-capped Mt. Hood standing guard, is probably the most productive pear orchard in Oregon if not in the world. Here, on soil that had its origin in the glaciers from the slopes of Mt. Hood, Rory Collins produces an average of about 1000 boxes of choice pears per acre. His record is 1500 boxes per acre, and he is striving for a 2000-box production.

The soil on which the Collins orchard is located is classed as Parkdale loam. It is yellowish brown in color with a rich layer of leaf mold on the surface that is higher in nutrient content than any other portion of the soil profile. The top six inches of mineral soil likewise contains a considerable portion of humus and available nutrients. Below this depth nutrients are much less abundant.

The soil is deep and easily permeable to water and tree roots. There is a little more silt in the deeper soil and less clay than in the surface, but only a low amount of clay in any part of the soil depth. The soil structure is the granular crumb formation, sometimes described as the "melt in your mouth" structure and labeled the "key to soil fertility."

In his early years of farming, Collins acquired a herd of Jerseys which afforded some income and considerable manure for fertilizing the orchard. Though the Jerseys were disposed of several years ago, Collins is still continuing the practice of applying manure to the orchard.

The most apparent limiting nutrient element, except nitrogen, is phosphorus, the availability of which is so low that only a trace of it can be detected below the top six inches of depth. The supply of both calcium and potassium, particularly in the top soil, is near neutral, which is favorable to plant growth and production.

Collins' system of orchard soil management hinges upon the idea that a good soil, well fertilized, is necessary to produce a thrifty and consistently productive tree. Humus renewal is given major attention by growing a permanent cover crop, which is returned to the soil, along with the leaves from the trees and the relatively few prun-

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Cleveland, Ohio, October 1949

ings that result from removal of dead wood and the opening of passageways to facilitate harvesting.

These sources of organic matter are supplemented with frequent applications of manure, some of which is hauled a distance of 100 miles. Sawdust is occasionally hauled from a nearby sawmill and spread under the trees. When supplemented with liberal applications of nitrogen fertilizer, sawdust helps make humus. At the present time there is nearly two and one-half times as much humus in the top six inches of soil in Collins' orchard as in the deeper soil where the surface organic treatments do not reach.

No tillage has been practiced in the orchard for more than a dozen years. As a result, the surface of the soil and even the rotting litter on the surface are full of fine feeding roots of the pear trees that, undisturbed by plow or tillage tool, absorb moisture, nutrients, and oxygen. The "no tillage" system saves labor and tools, too.

The entire soil surface is covered with a rich leaf mold that affords perfect soil protection. The Parkdale soil erodes easily when unprotected. Being low in clay and in humus, when conventional management practices are followed, the soil lacks binding material to stabilize the structure. Even on relatively smooth surfaces with little slope, when irrigation water is turned into the open furrows in cultivated lands such as a strawberry patch, erosion occurs. The loose, fluffy soil seems to float with the water, and an irrigation furrow soon enlarges until it becomes a gulley. Not so under the Collins' permanent cover, which consists of a dense growth of grass and clover and weeds which stands thick and tall as a man.

To facilitate the harvest, a heavy log is dragged over the lush growth of cover crop just prior to picking. This lays the cover crop flat upon the ground, where it gradually rots and becomes humus. Then the picked fruit is stacked in boxes under the trees, on flat sleds or floats. A tractor draws the load out of the orchard and a mechanical loader automatically carries the boxes of fruit onto the waiting truck. Thus with a minimum of hand labor the choice pears move to the packing house.

Pear production as practiced by Collins is not hard on the land. The average production of 1000 boxes per acre, weighing approximately 25 tons, takes from the soil about 45 pounds of nitrogen, 18 pounds of phosphoric acid, and 67 pounds of potash per acre. At the present price of fertilizer, this is about $15 an acre. The much greater amount of nutrients required to grow the trees is re-

turned to the soil in large measure in the leaves and prunings which drop and rot with the cover crop.

This relatively small removal of fertilizer would be nearly replaced by the annual use of about 220 pounds of ammonium sulfate and 100 pounds each of superphosphate and muriate of potash. Much more than this goes into the soil annually by way of fertilizers, manure, and nitrogen fixation by legumes. In earlier days 10 tons of sheep manure an acre were sometimes used. This alone would furnish about 200 pounds of nitrogen, 70 pounds of phosphoric acid, and 200 pounds of potash, or considerably more than the crop removal.

In addition to the manure treatment, commercial fertilizers are liberally used, sometimes as much as 900 pounds an acre of cyanamid, which would supply at one application nearly 200 pounds of nitrogen in addition to lime. Superphosphate has been used also, usually in alternate years.

The humus and rotting litter so highly prized by Collins provide a larger circulating supply of available nutrients and make sure that the trees never fail to have access to all the nutrients needed for satisfactory growth and continuous production. And what is also important, the large amount of humus materials and the roots of the cover crop maintain the much desired granular, crumb structure, that is ideal for any crop.

Not only is soil fertility well maintained, but there is an abundance of irrigation water supplied by the melting snows of Mt. Hood and the surrounding territory. Water is applied twice a month or as often as is necessary. Because of the permeable soil structure there is no problem of surface runoff and waste of water. Neither does the soil become waterlogged from irrigation or natural precipitation.

The older pear trees are becoming so large that there is competition for light. Collins plans to gradually replace the overgrown trees by taking out every other one and replanting with a young tree. By replacing a small part yearly, the orchard can be gradually renewed without causing much loss in production.

Collins is well satisfied with his "scientific neglect" system of soil and tree management and his easy handling of fruit. And well he might be, for his methods have resulted in exceptional yields, in lowering cost of production, in greater profits, and in more leisure hours for the enjoyment of life to the fullest.

How Fat Should A Hog Be?

Condensed from The Ohio Farmer

T. C. Byerly

Bureau of Animal Industry, U.S.D.A.

How fat should a pig be? Is it in the interest of farmer, processor and consumer to produce leaner pigs? First, a pig must be fat enough to produce a firm carcass. Research at the bureau of animal industry station at Beltsville, Maryland, and at cooperating state experiment stations has demonstrated this. Pigs produced on a typical diet, largely of corn and with adequate protein and mineral supplements and green forage or alfalfa hay or meal, must have at least 1½ inches of back fat to yield firm carcasses as 225 pounds live weight. It is possible to obtain a firm carcass in a 100-pound pig with only 0.8 inch of back fat on a diet consisting chiefly of potatoes or polished rice or barley with skim milk. Other feeds vary with respect to their effect on hardness of fat.

The quickest and surest way of increasing the proportion of meat to lard is to produce more pigs and market them at lighter weights. Slaughter weight is a principal controlling factor in relative lard and meat yield.

The average number of pigs saved per litter varies from year to year between 6.0 and 6.5 in the United States. In some North European countries an average of 8 or more is achieved. About 600 pounds of feed in addition to pasture and good quality alfalfa hay in racks are required to carry an average sow through the gestation period. It takes another 600 pounds to carry her through the suckling period until the pigs are weaned. Each pig of a litter of six weaned represents an investment in feed of 200 pounds; each of a litter of eight only 150 pounds.

There is information at Beltsville to show the amount of feed required to produce 100-pounds live weight of pig at successive body weights for pigs in litters of six and eight. This shows a very sharp drop in feed required per 100 pounds up to a live weight of 175 pounds, a slight increase at 225 pounds, then a sharper increase at heavier weights.

The data include both feed required to produce the pigs to weaning and the feed required by the pigs after weaning. These figures show that the eight-pig litter at 200 pounds average live weight will have cost 6160 pounds of feed for the 1600 pounds of pigs produced. The six-pig litter

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Cleveland, Ohio, October 15, 1949

must be carried to a live weight of 267 pounds each to produce 1600 pounds live weight and will have cost 6650 pounds of feed. Thus, the same tonnage of pigs could be marketed at a weight yielding a higher percentage of lean cuts and at a feed cost of almost nine bushels of corn equivalent less for the eight-pig litter than the six-pig litter.

Number of pigs weaned per litter can and will be increased as selective breeding and better management practices are adopted. However, much research remains to be done in the field of disease. Also inheritance plays a big part in being able to produce a national average of 8 pigs saved per litter.

There are still other reasons why feeders produce fat pigs. In general, the more rapidly gaining pigs tend to be fatter than the less rapidly gaining and are likely to be retained by farmers and breeders as breeding stock.

Another reason often given for producing fat pigs is that packer buyers prefer that kind. Now it is true that there is a relation between fatness and carcass yield. In general, each added 0.1 inch of back fat is associated with an increase in dressing percentage of about 0.4 per cent—an extra pound yield on a 225-pound pig. What if it is lard, it's an extra dime isn't it? Or is it?

On the basis of prices taken from a recent issue of the National Provisioner for wholesale cuts and lard, the products produced from 225-pound Beltsville pigs with 1.3 inches of back fat were worth $24.42, while the products from pigs with 2.2 inches of back fat were worth only $24. The leaner pigs were worth 95 cents apiece more than the fatter ones in spite of the almost three per cent higher dressing percentage of the fatter pigs.

Nor is low dressing percentage necessarily associated with lean pigs. For example, let's look at data for the Chester White-Landrace line at Beltsville. This is an outstanding line with respect to yield of preferred cuts—ham, loin, shoulder, shoulder butt and bacon totaling about 49 per cent of slaughter weight. It has an averaged dressing percentage for the line of 80.7 per cent. The fattest of the Beltsville lines showed an average dressing percentage of 80. We anticipate that careful selective breeding will produce true breeding lines which will produce pigs which will grow at an outstanding rate, yield a high dressing percentage and a high percentage of preferred cuts. Meat type individuals and perhaps lines of pigs now exist in all of the American pure breeds. Recognition and propagation of such pigs merit a concerted effort.

The variation in lard yield among 225-pound pigs is further

illustrated by this example. The average 225-pound pig yields about 45 per cent of its slaughter weight as preferred cuts and 28 pounds of lard. Selected lines of pigs developed at Beltsville from crosses of Danish Landrace x Poland China and Danish Landrace x Chester White consistently yielded 49 per cent of preferred cuts and about 24 pounds of lard at 225-pound market weight. Carcasses of these two lines of pigs average a trifle over 1.6 inches of back fat.

Relative yield of meat and lard has also been shown at Beltsville and state research stations to be greatly affected by level of feed intake and level of proteins in the diet. Pigs raised on a daily feed intake of two per cent of body weight may yield as little as 15 pounds of lard at 225 pounds. Obviously, reduced feed intake prolongs the time required to reach slaughter weight. Up to 100 pounds weight it is economically necessary and desirable to grow pigs as rapidly as possible. Beyond that weight, controlled level of feeding may have some merit.

Pigs fattened on diets differing in protein from 13 to 19 per cent will decrease in lard yield by about one pound for each increase of one per cent in protein level and increase one per cent in yield of preferred cuts on a diet of corn and mixed animal protein type diet.

There is one more major question as to the practicability of producer control of lard production. A major portion of commercial hogs are produced on self-fed corn and a supplement either hand-fed or self-fed. Dr. W. A. Craft, in charge of the regional swine breeding laboratory at Ames, Iowa, is pessimistic about controlling fatness in pigs produced under this system.

Research is needed to determine whether a protein concentrate exists or can be devised which will induce pigs self-fed on corn to balance their diet at a protein level which will assure a high proportion of lean meat.

You all know the soft pork story and the effects of self-feeding soybeans. Feeding whole oil seeds to swine can only be defended as a cheap way of harvesting a crop. Not only is soft pork produced but raw oil seed proteins are not used very effectively by pigs. Cattle and sheep, on the other hand, use these raw proteins as well as any others. Greater use of whole soybeans in feeding cattle and sheep may be practical. Fattening lambs in Beltsville experiments did very well with whole soybeans as the concentrate feed. Gains were satisfactory and body fat was not softened appreciably. Data for beef cattle from experiments at several stations indicate that oil seeds have little effect on hardness of beef fat.

Cutting Farmers' Fire Losses

Condensed from Agricultural Situation

John D. Rush

Bureau of Agricultural Economics, U.S.D.A.

EACH year in this country, fires burn up about 100 million dollars worth of farm property and cause incalculable losses in human suffering. Reasonable care probably could cut these losses in half.

The heavy load fires impose on farmers is brought out in a study recently made in South Carolina. Each year during and since the war, a fire has broken out on one out of every 52 farmsteads in the State. About 70 per cent of these blazes occurred in farm dwellings and the rest in barns and other outbuildings.

The high rate of destruction from South Carolina fires indicates that farmers would gain much from efficient rural-fire-protection programs. Losses from the South Carolina fires equalled about 43 per cent of the estimated cash value of the buildings and contents involved, and about 65 per cent of these buildings were completely destroyed. This is a much higher "demolition rate" than in cities where modern fire-fighting equipment, fire-alarm systems and hydrants are available.

Of the homes that caught on fire, slightly more than half were completely destroyed. Nine out of ten of those occupied by tenants burned to the ground compared with 4 out of 10 of those lived in by owners. Of the barns that caught on fire, 90 percent were completely destroyed. The loss rate per $1,000 of property involved in fire was more than twice as great for barns as for dwellings and on all classes of property was about 30 percent higher for tenants than for owners.

Because of the high proportion of farm fires that result in total destruction, farmers' financial losses are often heavy even though their property is insured. Farm fire insurance seldom is offered for more than 75 percent of the property value. Thus, when the insurance is paid in full for a building completely destroyed, the farmer usually takes at least a fourth of the loss. In periods when property values are rising the proportion of insurance to the value of property declines. As a result, the farmers' financial risk becomes greater.

Insurance in force on South Carolina properties that caught on

Reprinted from Agricultural Situation
Washington, D. C., September 1949

fire amounted to 56 percent of the total value and insurance payments averaged about 54 percent of the estimated loss. This means that the other 46 percent of the loss was borne by farmers.

Farmers can do much to reduce chances of severe loss from fire without a great expenditure of either time or money One of the first, and in many ways the most important, things to do is to adopt and follow a few simple rules. Keep the attic, basement, outbuildings, and the place generally free of trash and rubbish that can cause fire or attract lightning. Store gasoline, kerosene, oils and other inflammable materials at a safe distance from buildings. Provide a safe place to dispose of hot ashes from the stove or furnace. Watch the careless smoker or the child with matches—every year they start fires that burn up a lot of valuable property. Be very careful in using kerosene to start a fire in a stove. Be sure hay is well cured before putting it in the barn unless these is a safe mow-curing system.

Inspect the lightning-rod system at least once a year. If there isn't a system on the place it probably would pay in the long run to have one. Each fall it is a good idea to check over chimneys and flues for cracks that would permit flames to reach other parts of the house. These are two very important precautions. According to the National Board of Fire Underwriters, lightning is the most frequent cause of farm fires while defective chimneys and flues rank second.

Farm buildings roofed with metal or composition materials are safer from fire than those covered with wood shingles. The South Carolina study shows that loss rates for buildings with wood roofs to be a third higher than for those covered with noncombustible materials.

The farmer needs to be prepared to fight fires that break out. A ladder long enough to reach the top of the highest building should be kept in a handy place. If there is a water system on the farm, a few well-placed hose connections are good protection. If there is no water system, a barrel of water tightly covered should be kept at every building. It's a good idea to paint them red and stencil FOR FIRE ONLY on them in large letters to prevent the water from being used for some other purpose. In addition, one or two fire extinguishers, at least one of which can be used for fighting electric or oil fires, should be installed in all buildings. A 5-gallon back-pack pump extinguisher is especially valuable for fighting small wood and rubbish fires.

Fires may break out even though hazards have been reduced to a minimum and sensible protective measures have been taken.

Sometimes the only thing that may save farm buildings is an efficient rural fire department. It frequently can save the building and usually can prevent the fire from spreading to other buildings.

Organization of rural fire fighting services has made considerable headway in recent years. There are two main types. The first is the voluntary plan in which farmers cooperate in buying a fire truck and place it with a nearby city or village department to be used upon call by the farmer subscribers. In come cases, farmers get service from a nearby village by paying a fee. Funds to buy a fire truck and other equipment often are raised by public subscriptions or by carnivals or other entertainment.

The second type of community fire protection is the tax-supported type of program. Twenty-six States have laws covering the organization of rural fire-protection districts. To form such a district, these laws usually require a petition signed by a certain number or percentage of farmers in the area. The petition is presented to a county or township official who calls a meeting to discuss the matter. If the proposal is accepted in the meeting an election is set. Costs of establishing such districts have been as low as 1 mill per dollar of the assessed valuation of the protected farm property.

Another type of tax-supported program is the county or township fire department. These departments serve a fixed rural area and often can be established by county or township officials without an election. Seventeen States have laws providing for township fire departments while 11 States provide for the organization of county departments.

Rural fire-fighting departments have resulted in great savings to farmers. For example, records of the Kent County, Mich., fire department show that $385,000 worth of property was saved in the 15 townships served during the first 2 years of operation. In contrast, the South Carolina survey showed that only one of the fires studied was attended by a nearby city fire department. Even then, the truck arrived too late to put out the fire since there was a delay in sending in the alarm.

Farmers also have banded together to protect themselves financially against fire losses by organizing farm mutual fire insurance companies. Nearly 2,000 of these companies are in operation throughout the country and they have proved to be one of the most successful forms of rural cooperation. Many of these mutuals have taken the initiative in promoting rural fire protection and have helped farmer members remove many of the hazards that have caused fires.

Corncobs Make Good Beef

Condensed from Ohio Farm & Home Research

P. Gerlaugh, W. Burroughs and L. E. Kunkle

TESTS at the Madison County Experiment Farm over a period of years have shown that nine-tenths of a pound more gain on cattle and pigs resulted from a bushel (70 lb.) of corn fed as corn-and-cob meal than when a similar bushel of corn was fed as shelled corn (56 lb.).

Cobs thus showed a surprisingly high return in those tests. Whether their value is due to physical properties or to chemical properties is not known.

An appropriate question arose as a result of those tests. Was 14 pounds of cobs to 56 pounds of shelled corn the best ratio of corn and cobs in a corn-and-cob meal ration for fattening steers?

To obtain some of the answers to this question, a series of tests was set up which used approximately twice the normal amount of cobs in the corn-and-cob meal used in fattening steer rations.

Ground shelled corn, regular corn-and-cob meal, and a corn-and-cob meal containing added cobs were the feeds compared. These feeds were prepared from the same stock pile of ear corn. A ton of ear corn was shelled and the percentage of cobs in the ear corn obtained. This same percentage of cobs was added to a load of ear corn as it went to the grinder. Another load of ear corn was ground into regular corn-and-cob meal. A hammer mill was used in preparing the corn. The same screen was used for all feeds.

Soybean oil meal (44% solvent process) at the rate of two pounds per steer per day was fed throughout this series of tests. Mixed clover and timothy hay was fed in such amounts as the cattle wanted. No corn silage was fed in these tests.

Five pounds of a mineral mixture of 2 pounds limestone, 2 pounds bonemeal, and 1 pound of salt was added per hundredweight of soybean oil meal.

Salt was also available to each lot from a salt box.

In December 1942, a test was started with 20 steer calves per lot, weighing about 485 pounds each. The three lots were group-fed for a period of 252 days.

During this feeding period the lot fed ground shelled corn ate an average of 11.3 pounds of ground shelled corn, 2 pounds of soybean oil meal, and 4.2 pounds of mixed hay daily per steer. Gain per day was 1.97 pounds.

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Wooster, Ohio, May–June 1949

The lot fed the regular corn-and-cob meal consumed 12.4 pounds of corn-and-cob meal daily. This corn-and-cob meal was made up of 10.1 pounds of ground shelled corn and 2.3 pounds of cobs. These steers ate 2 pounds of soybean oil meal and 4.2 pounds of hay daily. They gained 1.99 pounds per day.

The corn and added cob meal lot ate 8.6 pounds of ground shelled corn, 3.9 pounds of ground cobs, 2 pounds of soybean oil meal, 3.8 pounds of hay daily. They gained 1.93 pounds per day.

On the basis of feedlot performance, the cobs in the regular corn-and-cob meal were worth 57% of their weight in shelled corn in producing gains in comparson wth the lot fed ground shelled corn. Cobs in the corn-and-added-cob meal lot were worth 64% of their weight in ground shelled corn.

At slaughter in New York City the dressing percentage and carcass grades of each lot were obtained. The ground shelled corn fed lot dressed 61.05%, the regular corn-and-cob meal lot, 59.93%, and the corn and added cob meal lot, 59.36%.

There were two carcasses grading good in each lot, with the rest grading choice or choice plus.

In order to compensate for the lower dressing percentage of the corn-and-cob meal and the corn and added-cob meal fed cattle, the amount of ground shelled corn and the cobs fed to each lot was divided by the shrunk carcass weight of each lot to find the amount of ground shelled corn and ground cobs necessary to produce 100 pounds of carcass in the respective lots.

By this method, the cobs in the regular corn-and-cob meal were computed to be worth 48% of their weight of shelled corn in producing carcass weight with no handicap on the grade of carcass. The cobs in the corn and added-cob meal lot had a value of 62% of their weight in shelled corn.

The same year three lots of 12 head each were fed individually on the rations mentioned above for the group-fed lots. These cattle ate nearly 2 pounds per steer less ground shelled corn and correspondingly less of the corn-and-cob meal and a little more than a pound less of hay than the group fed cattle. Their gains were 1.72, 1.76, and 1.62 pounds per day for the ground shelled corn, the regular corn-and-cob meal, and the corn and added cob meal lots, respectively. These lots were sold at the close of the 252 days test, though their condition of flesh was not satisfactory. The cob replacement values in this test on the basis of feed lot performance was higher than for the group-fed cattle, though the test is not considered a satisfactory comparison because of the slow performance of all three

lots. The results of these three lots are not used in this summary.

The following year the same test, minus the individual fed steers, was repeated with yearling cattle, weighing about 705 pounds each at the start of the 196-day feeding period. The lots of 12 were fed as three lots of 4 head each. The feed consumption and gains of these small lots were similar to those obtained from the groups of 20.

These cattle were slaughtered at Cleveland, with dressing percentages and carcass grades similar to those taken from the previous test.

When the cob replacement values, on the basis of the shrunk carcass weights were figured, a 51% replacement value for the cobs was found in the regular corn-and-cob meal and 68% when the corn and added-cob meal ration was used.

In the third year's comparison, with a lot of 20 and a lot of 12 on each ration, 620-pound steers were fed 238 days. The feedlot results were similar to those obtained the previous two years. When marketed, the dressing percentages were closer together though the carcass grades favored the ground shelled corn fed cattle more than previously. The replacement value of the cobs in the regular corn-and-cob meal was 65% of the weight of ground shelled corn, while the cobs in the corn and added-cob meal were worth 57% of their weight of ground shelled corn in producing carcasses.

A summary of the three years' work showed a shelling percentage of 18.3% cobs in the ear corn, an average daily gain of 1.92 pounds for both the ground shelled corn, and the corn-and-cob meal fed calves, while the corn and added-cob meal fed steers gained 1.85 pounds. The three year average replacement values of cobs on the basis of feed lot performance was 61% in the regular corn-and-cob meal, and 69% in the corn and added-cob meal fed lots.

The replacement values of the cobs on the basis of feed lot performance is somewhat misleading due to the fact that the steers fed both of the corn-and cob meals yielded slightly lower dressing percentages. Carcass weights instead of feed lot gains were used as a basis for the three-year average replacement values. Cobs in the regular corn-and-cob meal were worth 50% of their weight in shelled corn; cobs in the corn and added-cob meals were worth 62% of their weight in shelled corn.

The 62% replacement value for the cobs in the corn and added-cob meal lots lowers to 55% when the increased amount of soybean oil meal per cwt. of gain is taken into consideration. There was little difference in the grades of carcasses produced.

This series of tests at Wooster showed as did the Marison

County tests, that the cobs in regular corn-and-cob meal have a substantial feeding value. Also, cobs which were added to the regular corn-and-cob meal (about 18%) were worth as much as the cobs in the regular corn-and-cob meal.

Hogs followed the three lots of steers in the first test (1942-1943). During the early part of the second test it became impossible to keep the manure removed sufficiently to prevent the pigs from getting into the cattle's feed troughs. The pigs were removed from the lots rather than have them mussing the cattle rations.

During the first year the pigs following the steers fed the corn and added-cob meal did as well as the pigs following the ground shelled corn fed cattle, even though the cattle were fed 24% less ground shelled corn. Pigs following well-fed cattle doubtless salvage valuable nutrients other than undigested particles of corn.

30 Calves A Year From Your Best Cow!

Condensed from Farm Journal

Cameron Hervey

A FEW years ago artificial insemination made big news, just about the biggest in centuries of cattle breeding.

Now comes news even more startling—and probably just as important—a way of getting more offspring, not from the male, but from the female!

Scientists are right now within reach of something they've tried to do for years—gathering fertilized eggs from one cow and transferring them into the reproductive systems of other cows, where the eggs would grow into calves.

Three cows have already carried calves that weren't their own, for about 100 days. Then they've aborted.

Those abortions haven't dismayed the man who has been the principal experimenter with what he calls "egg-transfer breeding".

The method of transferring has now been so well perfected that just one or two eggs can be inserted into each "incubator" mother with a good chance that live calves will be born.

There's a second tool, almost as unusual, involved in this new "egg transfer" method, and it's called "superovulation."

Ordinarily a cow produces just one egg at a single heat period. But if she is injected in the neck with certain hormones—an ex-

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Philadelphia, Pa.

tract of sheep pituitary glands—she can be made to produce 10 to 140 eggs as often as a dozen times a year if she is left open.

That means that it's altogether possible that a cow may become the actual mother of 30, 50, 100, or even more calves a year.

Think of what that would mean—100 calves a year from a cow like Carnation Ormsby Butter King and the other world-beaters at the pail.

When the few remaining problems are solved, egg-transfer breeding may well become our most important tool for livestock improvement. For then we will be able to get hundreds—perhaps thousands of calves (maybe foals, pigs, and lambs, too) from our very best breeding stock.

Ray Umbaugh is chiefly responsible for developing the technique that may bring mass-production maternity to the nation's farms.

Umbaugh used to wonder, as he milked his father's cows back in Indiana, why so many barns were filled with livestock that barely earned their keep.

If only it were possible, Umbaugh thought, to let poor cows do the 9-month job of bearing calves, and thereby let champion cows take it easy and produce nothing but eggs! If that could be done, along with artificial insemination, then you could turn out champions with the ease of a factory production line.

Umbaugh's plans were interrupted when he was called into the Army Air Corps as a flight instructor. But before long, he had persuaded his commanding officer to let him buy some cows, stable them near the airfield, and experiment on them in his spare time!

After the war, Umbaugh continued his work in North Carolina, Massachusetts, and Texas. So far he has worked with more than 750 cows. And he has very nearly reached his goal.

After the eggs are fertilized by artificial insemination, Umbaugh gathers them through an opening in the side of the cow, a fairly minor operation—or by flushing out the uterus. The eggs can be stored without damage up to 28 hours—long enough to be shipped by air to almost any place in the country.

Umbaugh then takes each fertilized egg and with instruments similar to those used in artificial insemination, places it in the uterus of another cow. That's all there is to the job.

Here's how Umbaugh thinks the business of egg transfer might work in actual practice: A farmer would buy the fertilized eggs of a prize-winning cow, and have a trained technician put them into the reproductive tracts of his own cow. (Eggs are inserted about four days after the heat period is over.)

After the usual pregnancy period, these "substitute" mothers would give birth to normal calves.

Not one of these calves, though, would be related in any way to the cow that gave birth to it! Instead, their real sires and dams would be from among the production kings and queens of the cattle world.

Such a service would cost far less than buying an entirely new herd, or taking years to grade up the old herd with a good bull.

Although there have been no living calves produced, Umbaugh will soon know whether or not he can clear this last hurdle. He is hard at work transferring eggs (only one or two to a cow this time!) to nearly a thousand substitute mothers. In just a few months now, he'll have that all-important final proof.

As long ago as 1905, an Englishman was able to get a live, healthy litter when he transferred rabbit eggs. Umbaugh has repeated this neat bit of rabbit magic, and other U. S. scientists have succeeded with guinea pigs and other small laboratory animals as well.

There is no reason, Umbaugh believes, why he shouldn't have as much success with larger farm animals.

When the method is perfected, there are several ways that egg-transfer breeding can be adapted to farm use. Artificial breeding association technicians, according to Umbaugh, could be easily trained to handle egg transfer. And the eggs could be supplied from outstanding cows in each association, or from cows purchased by the associations especially for egg transfer.

Another solution would be for the associations or independent investors to set up a central laboratory where fertilized eggs would be produced by the very best bulls and cows it would be possible for money to buy. These eggs could then be sold to local breeding associations for transfer by their own technicians.

Will egg transfer work for horses, sheep, and hogs? No one knows yet, but Umbaugh plans to work with them when his cattle research is far enough along.

During the coming year, Umbaugh will continue his breeding experiments at a ranch near San Antonio, Texas, which is associated with the Foundation of Applied Research. The Foundation was set up and has been largely supported by Tom Slick, Texas oil man and rancher.

Slick, who has put more than $125,000 directly into Umbaugh's cattle research, is certain he has spent his money wisely. "When egg transfer breeding is perfected," he says, "we should be able to improve our livestock more in 10 years' time than we have in the last century."

Radioactive Fertilizers

Condensed from Better Farms

C. W. Fisher, Jr.

Research Assistant, N. Y. State College of Agriculture

DOES radioactivity in fertilizers increase crop yield? Will fertilizers containing radioactive materials help produce more corn, more cotton or more carnations than fertilizers lacking radioactive substances?

These were a few of the questions raised in the minds of agricultural scientists that were to lead to some of the first exciting ramifications of the atomic energy development program. These are questions of vital import to the farmers and gardeners of today. Here's how they first came up, and why, and some answers to them.

In 1947 reports began to spread in Japan regarding a certain Farmer Furuno and his wondrous garden. Farmer Furuno had been raising crops on some land in Nagasaki on plots from 600 to 2,000 feet away from the point above which atom bomb number three exploded. He was amazed to find that the yield of his gardens during the first year of post-war cultivation was greatly increased over those he had ever obtained before. Of course all of the dangerous radiation effects in the area had worn off before he started farming, but there was still considerable residual radioactivity in the soil on which he planted his crops. Here was one possible explanation for his remarkable yield, and he jumped at it. Radiation, still remaining from the bomb blast obviously, he thought, must be the reason for the crop increases. In some way the plant was modified by it so that better growth resulted.

The news, like many sensationalisms, traveled far and fast. "Japanese farmer gets heavier crop yield by growing plants on radioactive soil," was an announcement that aroused agricultural interest in Japan and soon made headlines in this country. Indeed it's an ill wind that blows no good. And here at last, coming as an unpredicted benefit from the great destroyer, was perhaps a greater constructive counterpart. Here was perhaps the panacea for farming —radioactive soil! Or was it?

A commercial company engaged in mining radioactive materials thought that it was. Scarcely had the report been issued when a radioactive fertilizer material was put on the market, a sure thing, so the advertisements ran, for increasing crop yield. Radioactive fertilizer materials apparently were destined for a creative name

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928 Broadway, Buffalo, N. Y., September 1949

in agriculture as spectacular as the destructive name of the bomb itself. That's how the whole affair started.

There was great interest in this new material both in agricultural and scientific circles in this country. Some of the radiofertilizer was sold. There was plenty of it available since it was coming as a by-product of the mining operations. Where did the American farmer stand? Was radioactivity in the soil something that was commercially feasible and that would produce claimed results?

The United States Department of Agriculture, being vitally concerned with such problems, and working in cooperation with the Atomic Energy Commission, aimed to get at the truth of the matter. Experiments were set up at 13 state agricultural experiment stations as well as at the U. S. D. A. headquarters at Beltsville, Md., for the scientific testing of radioactive fertilizers.

The experiments at all stations were planned so that the commercial radioactive product was fed to crops at three rates of application, low, medium and high. Rates varied around the recommendations of application given by the manufacturer. At each station each rate of radiofertilization was repeated in ten experimental plots so results would not be based on single plot observations alone. Also, for another treatment, radium in minute amounts sufficient to produce radioactivity of the same magnitude as the medium level of fertilization was added to 10 experimental plots at each of the stations. This was the set-up. Cooperating stations were all over the country, Montana to Mississippi, North Dakota to North Carolina. Crops tested ranged from cotton to corn, and from potatoes to peanuts.

The aim was to test the materials on as wide a range of plant types and under as many environmental conditions as possible.

The results of the first year's testing can best be summarized by a release from the U. S. D. A. through the Agricultural Research Administration. They say: "These widespread one-season field experiments indicate strongly that the farmer cannot expect increased yields from money invested in the radioactive materials."

The U. S. D. A. is planning further trials in order to confirm their initial conclusion. That's the story as it stands today. Radiofertilizers, on the basis of scientifically controlled tests, appear to be of no benefit.

The question then arises as to how to account for the wonderful yields from the gardens of Farmer Furuno. Was radioactivity as such really responsible?

A team of American and Japanese agricultural scientists went to Nagasaki to investigate the situa-

tion. They suggested several possible answers to account for the yield increases. Radiation from the bomb blast, they believe, acted to sterilize the soil and eliminate harmful organisms there, such as nematodes, insects and pathogens. This alone might be the answer. Also the fires that followed the explosion left an ash deposit that was high in nutrient element content. In addition there is the possibility that Furuno's gardens were located on areas that previously had been covered by homes so that the soil beneath had never become depleted in essential fertilizer materials.

These explanations coupled with the finding that Furuno was applying fertilizer to his gardens at about five times the rate used by other farmers in the area adequately explain the results that he observed.

So don't jump too fast. In other words, don't waste time and money on radiofertilizers at this early stage in their development. The questions on the materials still are not answered with positive certainty. Maybe research will at some time indicate their benefits. But until then don't be misled—don't invest in radioactive fertilizers.

Use of Lime

Condensed from The Southern Planter

P. H. DeHart

Extension Agronomist, V. P. I.

THE use of lime in Virginia has increased from less than 100,000 tons during the period 1929 to 1932 to approximately 1,000,000 tons during the past few years. Old Dominion soils still need about 9,000,000 tons of ground limestone to put them in proper condition for maximum production and about 2,000,000 tons each year thereafter to maintain the proper soil reaction and supply the necessary calcium and magnesium.

In addition to supplying calcium and sometimes magnesium as a plant food, lime aids in a number of ways. A few advantages of lime are as follows:

1. Makes plant food more available. In very acid soils the phosphorus in the soil, or that added as a commercial fertilizer, is tied up with other soil minerals in a form that it is difficult for plants to use.

2. Loosens heavy clay soils. A soil that sticks to the plow and

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Governor Street, Richmond, Va.

turns over in large clods can sometimes be loosened up with lime. The lime causes the fine clay particles to form granules which result in a soil that will crumble when plowed and harrowed instead of remaining in hard clods.

3. Increases the ability of bacteria to gather nitrogen from the air. There are bacteria in the soil that will gather from 16 to 40 pounds of nitrogen per acre from the air even though legumes are not grown. These bacteria will not live in extremely acid soils. Then, there are bacteria that gather nitrogen from the air and store it in nodules on the roots of legumes. This benefit alone will more than pay for the cost of liming.

The application of 8 to 10 tons of finely ground limestone to the plow layer of soil is about the same principle as throwing ice water on an overheated horse or putting water in a red hot automobile engine. The sudden change is too much of a shock and no one would recommend that method of restoring the normal temperature.

It is not wise to use over 3 to 3½ tons of finely ground limestone or its equivalent per acre in the plow layer of soil at any one time, regardless of how acid or how heavy the soil may be. About 1 to 2 tons would be the limit on some sandy soils. If a larger quantity is needed, apply the above maximum quantity and plow or disc it in the soil and have a soil test made about 6 to 8 months later to find out how much more, if any, is needed.

There may be special conditions where larger quantities may be placed in the sub-soil below the plow layer with good results, but more experimental information is needed before this practice can be recommended.

The safest way to determine how much lime to use is to have a soil test made in a properly equipped laboratory. County agents, vocational agriculture instructors, and Soil Conservation Service technicians will furnish informaton on how to take soil samples and the location of soil testing laboratories.

The result of the test will be expressed in terms of pH values. A pH of 7.0 is neutral; below 7.0 is acid; above 7.0 is basic. Almost all crops, including alfalfa, do best in slightly acid soils. Therefore, it is seldom advisable to use enough lime to raise the pH to 7.0. For example, the best pH range for peanuts is 5.8 to 6.0; for a corn-small grain-clover rotation and pastures, 6.0 to 6.5, and for alfalfa, around 6.6 to 6.8.

If it is impractical to have a soil test made, the following general recommendations may be used. On heavy clay soils, that have not been limed for 8 to 10 years, an application of 2 tons of ground limestone or its equivalent will be satisfactory for crops such as corn,

small grains, red clover, dark tobacco, Burley tobacco or pastures. Only one-half this amount should be used on sandy soils. I would always use a soil test to determine the amount of lime needed for alfalfa, peanuts, flue-cured tobacco and most truck crops.

The kinds of lime are ground limestone, ground oyster shells, hydrated lime, burned oyster shells and marl. Regardless of the kind of lime used, the final product is the same. When burned lime or hydrated lime is applied to the soil, it changes to the same chemical compound as ground limestone. Therefore, it is obvious that the value of a lime is not determined by the form or kind of lime used. The value is determined by the fineness and purity.

A ground limestone, analyzing at least 85 per cent calcium carbonate, or its equivalent, and all of which will pass a 10 mesh sieve, which is about like a fly screen, and at least 40 to 50 per cent of it fine enough to pass a 100 mesh sieve will be satisfactory. This is assuming none of the finer particles produced in grinding are removed. This type will have enough fine particles to give immediate results and enough coarse particles to last through a 4 to 5 year rotation. The majority of commercial ground limestone sold in Virginia will meet these specifications. The minimum of 85 per cent calcium carbonate or its equivalent also applies to the other forms or kinds of lime.

Lime recommendations are usually made on the assumption that the material used will be at least as good as the above specifications. If the quality is lower, the quantity recommended must be increased to get the desired results.

Other things being equal, lime should be applied in the rotation before the crop that responds most to liming. In a corn-small grain-clover rotation, the ideal time is in the fall at time of seeding the small grain. However, due to supply and delivery difficulties, every one cannot expect to get lime spread during this short period. On pastures, the only practical method is to broadcast over land, preferably in the fall or early spring so the freezing and thawing will aid in getting the lime in the soil.

A successful soil management program to increase or even maintain soil fertility must include (1) the wise use of lime; (2) legumes; (3) crop rotations; (4) wise and efficient use of commercial fertilizers; (5) crop residues and farm manure; (6) green manure and cover crops. The use of lime will put the soil in a favorable condition to release plant food. When this is done, larger yields may be expected which remove more plant food. Therefore, the liberal use of plant food must accompany the use of lime.

Controlling Sweet Potato Sprout Decay

Condensed from New Jersey Agriculture

Robert H. Daines

For a number of years sweet potato sprouts in plant beds scattered throughout South Jersey have experienced injury from an unknown source. During this time, sprout failures have occurred in as many as 20 per cent of the sweet potato plant beds in this area, whereas many more (possibly up to 80 per cent) show characteristic injury in varying amounts.

The evidences of injury are limited to the sprouts since the sweet potatoes show no abnormal symptoms. The sprouts show brown necrosis, which cuts them off, and thus prevents their emergence above the soil. Frequently sweet potatoes show thick bunches of short branched sprouts with decayed tips produced by the decay of sprouts repeatedly produced by the sweet potato. This sprout decay frequently results in bare spots in a bed or even complete plant bed failures. Where injury is less severe, twisted sprouts instead of straight ones are also frequently observed.

The agent responsible for this sprout decay is unknown. Tissue isolations have not yielded an organism that is suspected of producing the necrosis. Reports have been made that the sprout injury is produced by the salt leaching out of the salt hay, and concentrating in the sand around the potatoes. Other suggestions concerning possible causes have included nematodes, nutritional deficiencies and toxic substances in the soil.

Whatever the cause of this sprout decay, it seems to be associated with the soil used. In several instances where plant beds were composed of soil from two sources the trouble has occurred in one soil only. On several occasions the line separating the two soils has been sharply marked by a good stand on the one side vs. none or few sprouts on the other.

On April 18 and June 16, two plant beds at Louis Sanguinetti's farm were filled with a Lakewood sand from a pit where soil, known to have produced two almost complete sprout failures, had been taken. This soil had a pH of 4.3 and possessed only a trace of soluble aluminum. At the time of bedding the sweets, (Yellow Jersey), various soil treatments and sweet

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New Brunswick, New Jersey, September–October 1949

potato dips were employed. Each treatment used was applied to an area 4½ by 6 feet. In this experiment such fungicides as fermate at various concentrations, a basic copper sulfate, and calomel were mixed with the soil in the plant bed while the potatoes were dipped with fermate and Semesan Bel.

In an attempt to determine whether nematodes are responsible for the injury, an area of the bed was treated with chloropicrin about 10 days before bedding time. Similar areas were also treated with DD Mix and Ethylene dibromide.

The theory that salt from the salt hay was producing sprout injury was tested by comparing areas which were covered with fresh salt hay versus two-year old well leached salt hay. This idea was further tested by adding sea water to an experimental area until injury from sea water was slightly visible.

Minor elements (boron, zinc, manganese, magnesium and molybdenum) were supplied to one section of the bed to meet such minor element needs as might occur. In an attempt to overcome the effects from toxic substances, superphosphate at varying quantities was added to experimental areas.

In these experiments only superphosphate gave consistent protection against sprout decay. Where superphosphate was used at the rate of 2000 pounds per acre, the stand of sprouts was about perfect. In the areas where this material was used at the rate of 1000 pounds per acre the general appearance of the bed was not quite as good as were the areas treated with superphosphate at a ton to the acre. Although the stand of sprouts was good, the height was not uniform. The other treatments were not effective in overcoming the sprout rot studied here. The areas which received these treatments as well as the untreated check areas were, at sprout-pulling time, largely bare as the following data illustrates:

USABLE SPROUTS AT PULLING TIME

Soil Treatment	No. of Sprouts
Superphosphate (18%) 1000# per acre	5099
Superphosphate (18%) 2000# per acre	4662
Chloropicrin	807
DD Mix	1371
Untreated Check	589

Although the cause for the decay of sweet potato sprouts, so common in plant beds in South Jersey, is unknown, superphosphate has given almost complete protection against this injury in two experiments this spring. This material was broadcast on the soil

in the plant bed and then raked in, after the sweet potatoes were bedded. Since superphosphate is not only cheap and safe at the concentrations used, its practical application in a large number of sweet potato plant beds in South Jersey seems justified.

Lindane for Fly Control in Barns

Condensed from Down To Earth

ENTOMOLOGISTS of the United States Department of Agriculture have approved lindane for use as a residual spray for fly control in dairy barns. Lindane is the essentially pure gamma isomer of benzene hexachloride. The Dow Chemical Company is offering a lindane formulation, Dow Lindane-25%-Wettable.

The government's approval of the use of lindane in dairy barns is most important because of the adverse reports on DDT for this use. While care should be used in applying, government entomologists report that lindane will not contaminate milk if used as directed.

As a residual spray for the control of flies, roaches, ants, and mosquitoes, Lindane-25%-Wettable formulations should be used at the rate of 10 pounds in 100 gallons of water. The spray should be applied at the rate of two gallons per 1,000 square feet to walls, ceilings, beams, window sills, and other places where insects come to rest. Coarse sprays are desirable, and power sprayers with agitation and less than 100 pounds pressure are recommended. The spray should be applied so as to wet all treated surfaces thoroughly to the point of run-off. Milking utensils should be covered or removed from the building while spraying. Feed, forage, and drinking and feeding troughs should not be sprayed. Troughs should be washed out immediately if sprayed accidentally. Manure piles, refuse heaps and other breeding areas should be sprayed liberally at the rate of four pounds in 100 gallons of water every three or four weeks, or at three-to-four day intervals if manure is being added daily.

Dow Lindane-25%-Wettable is recommended for the control of lice on beef cattle. It should be used at the rate of 1½ pounds in 100 gallons of water applying two gallons of spray to an adult animal. The product should not be used on calves less than three months old or on cattle later than 30 days before slaughter.

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Midland, Michigan, Fall 1949

Dairy cattle may be treated for mange control but their milk should be discarded for 48 hours after treatment.

For scab or Sarcoptic mange mite on beef or dairy cattle use 1½ pounds in 100 gallons of water, applying two gallons of spray to an adult animal, using a sprayer giving about 400 pounds pressure. Complete coverage is essential for good control. Two applications a week to 10 days apart are required for a complete cleanup.

Extensive experiments by both federal and state research workers showed that lindane, applied as a residual spray, is effective even against house flies that developed resistance to DDT and to methoxychlor. Applications usually remain effective for about three to six weeks.

Collaborative tests conducted by the Bureau of Entomology and Plant Quarantine, the Food and Drug Administration of the Federal Security Agency, Rutgers University, and the manufacturers of lindane insecticides have shown that if residual applications are made according to recommendations milk will not be contaminated. Lindane is a highly refined material and is virtually free of the "musty" odor associated with technical grades of benzene hexachloride. No adverse odor has been detected in the milk from herds housed in barns treated with this material.

Lindane-25%-Wettable can be used on horses for lice, on hogs for hog lice and mange mite, and on sheep and goats for ticks, lice and scab mites. For all these animals, a spray can be used at the rate of 1½ pounds per 100 gallons of water. Colts should not be sprayed.

Sheep and goats may be sprayed or dipped. A single dipping is usually sufficient for control but a second spraying may be necessary for good control if spraying is used. Fall treatment is ideal, but in some areas a spring treatment after shearing of sheep may be necessary.

The product may also be used to control ticks and chiggers on vegetation. Foliage should be covered thoroughly with a spray containing two pounds in 100 gallons of water.

Alaska

Condensed from Commercial Fertilizer

Churchill Fisher

ACCORDING to a report by the United States Department of Agriculture, there are 100,000 square miles in Alaska of land suitable for farming.

The annual value of farm products in the Territory has been estimated at $2,500,000. The report covers farming from the Panhandle—southeastern Alaska— to the truck gardens at Bethel, up on the Kuskokwim, those at Holy Cross, on the Yukon, the gardens at Nome, and at Wiseman, ninety miles north of the Arctic Circle.

And yet with all its farm land, with the great farming regions of Matanuska Valley, the Kenai peninsula, the Tanana Valley, the Upper Kuskokwim and parts of the Yukon Valley, not to mention small areas of suitable farm land here and there, Alaska comes nowhere toward feeding her population of some 90,000.

A very few figures will show how far short of adequacy is Alaska's farm produce: in 1940, the value of evaporated milk imported was $441,842; in that year 1,957,251 dozen of eggs were brought into the Territory; the value of fresh and canned vegetables including potatoes was $1,060,819; of meat products, $2,316,571; and the total value of all imported food was $8,200,000.

In the eighty years since we acquired the Territory, farming has not gone ahead as one would expect; probably, because agriculture here presents some peculiar problems. First, there is terrific effort involved. Next, an initial investment of at least $5,000 (some would place the figure higher) is necessary; and lastly, would-be farmers must understand their soils and crops, and know what commercial fertilizers to use and in what quantities. These matters in hand, with the right location, a living may be made at farming. Because there is but one railroad, and no regular boat service along some water-ways, and few highways, farming has been that of mere subsistence. But the industry is surely but slowly coming into its own.

Even the poor farming area of Southeastern Alaska shows what increased knowledge may do: here the mountains are near the coast, and only small plats here

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Atlanta, Ga., August 1949

and there, in river valleys, at the heads of bays, and some grassy tide flats are usable. Though the soil is often rich and black, the persistent rains have caused the land to be heavily forested or else to become muskeg with a dense over-growth of low shrubs. Either sort of land demands a great outlay of effort. To clear forest land, the Department of Forestry estimates, will cost about $1,500 an an acre. The muskeg, formerly looked upon as hopeless, has proved productive when cleared, drained, torn up and treated with lime.

Usually, soils and sites with natural drainage, which catch the sunshine, and which have the longest growing season are preferred. Soils with considerable beach sand and fine gravel are liked in this region, and these again demand fertilizing. The river valleys are not so popular, being in the shade, with heavier forestation, and are colder, with more snow in winter.

These Southeastern Alaska regions are not suitable for grain or for field crops because of the extreme wetness. But whether the cultivated plot is of forest or of muskeg, the farmer must understand soil conservation or the value of his work will soon be lost through exhaustion and through erosion. The Agricultural Extension Service in Alaska is eager to help with advice and in carrying out an educational program. Payments are made to farmers who carry out certain improved practices in farming.

No doubt, ignorance has in the past brought into ill repute Alaska grown vegetables. Local markets refused these, preferring those shipped up from the States, despite the added expense of freight. But no longer are the local products denounced as tough, watery, or deformed; with knowledge of the use of commercial fertilizer, vegetables are produced that the consumer prefers to those shipped in.

That Alaska potatoes, for instance, could be a success was proved by Alex Bolam, of Cooper's landing, on lower Kenai Lake, when he took top honors in 1935 and '36 for his White Gold potatoes in a national contest. And now where a market is available potato growing is profitable. According to the Experimental Farm at Fairbanks, best results came from using a home mixed blend of sodium nitrate, superphosphate, and potassium sulfate in certain ratio, with the addition of ammonium sulfate, using 450 pounds to the acre just before planting. For high value of seed potatoes a feeding of superphosphates brought good results.

Do Steers Need Room?

Condensed from Kansas Farmer

Ed Rupp

For maximum gains steers in dry lot must be confined closely. That is a recommendation Raymond Hoyt, of Kansas, makes unhesitatingly after an experience of his last fall. With too much room to move about, steers will not put on pounds like steers in close quarters.

Mr. Hoyt's cattle program consists of a good-size cow herd with creep-feeders out on range for calves. This is the stable portion of his program. Then, for additional feed and forage that he produces, he runs a deferred-steer program to correspond with available feed supplies.

His surprising experience of last fall occurred right in his feeding pens. He started with 4 pens. Pens 1, 3 and 4 were somewhat alike, but pen 2 was considerably longer than the others.

September 30, steers were run into the feed lots after being out on pasture. He weighed them in. In pen 2 he put 105 head that averaged 725 pounds. Lot 1 held 56 head that weighed in at 663 pounds. Lot 3 held 55 head that weighed in at an average of 871 pounds. Lot 4 held his creep-fed calves, starting with 79 head.

The grain consisted of a mixture of milo and corn, 25 bushels of ground milo to 100 bushels of corncob meal. On full feed his dry-lot cattle were eating between 14.5 and 15 pounds of grain and cake a day in 2 feedings. Each head received 3½ pounds of cottonseed cake a day. In addition the steers were eating a mixture of alfalfa and prairie hay, about 3 pounds of alfalfa and 4 pounds of prairie hay each day for each steer.

On October 26, Mr. Hoyt decided to run a check on his feeding program. All cattle on feed were run across the scales. Look at lot 2 first, the big lot. From September 30 to October 26 these 105 steers had gained from a start of 725 pounds to an average of 773 pounds. A little less than 50 pounds each in 26 days. Not quite 2 pounds a day.

Steers in lot 1 did much better. These 56 head gained an average of 82 pounds in the same 26-day period. They jumped from 663 pounds to 745 pounds for an average daily gain of 3.1 pounds. They had the same feed and the same treatment.

Lot 3 did even better. These

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Topeka, Kansas, January 15, 1949

55 steers gained from 871 pounds up to 962 pounds in the same time. That accounted for an average daily gain of 3.5 pounds for each steer in that pen.

Mr. Hoyt was far from satisfied with the gains made by his steers in lot 2, when compared with gains registered from lots 1 and 3. He noticed when driving into lot 2 with the feed truck that steers would run to the opposite end of the lot. Then there was more room for these steers to run about during the day between feedings and the distance to the water tank was greater.

Figured out in dollars and cents, each steer in lot 2 was at least $8 behind the other 2 lots in the 26-day period on the same feed. Then he made a decision. Lot 2 would be cut in half and a temporary water tank would be installed. This done, the steers were divided just as they came. They were not selected.

He ran another check on his cattle November 24. Those 105 steers in lots 2A and 2B registered an average gain of 100 pounds in the 28-day period. There it is, 3.57 pounds a day.

He checked the other lots on the same day. Lot 3 was up to par. These 55 steers gained an average of 102 pounds in the 28-day period for an average of 3.64 pounds a day. He had some difficulty with lot 1 which dropped the average for that period down to 2.1 pounds a day for the same period.

Dividing lot 2 in half changed the rate of gain from a little less than 2 pounds a day up to 3.57 pounds a day. There was no feeding change—a fence did the job.

Since calves in lot 4 were a different age, it may not be a fair comparison, as Mr. Hoyt points out. But they did make correspondingly good gains. These creep-fed calves were fall dropped in autumn of 1947. They were taken from the cows last summer, July 16. They went into the dry lot at an average weight of 496 pounds. He sold out a few and ran in a few others. But average weight September 10 on 79 head was 592 pounds.

Weighed again October 26 with the others, 69 head had gained 106 pounds each in 46 days for an average of 2.3 pounds a day. The total average weight was 698 pounds. Nine head sold at Wichita with an average weight of 703 pounds. Weighed again November 24 with the others, the remaining 69 head averaged 778 pounds, a gain of 80 pounds in 28 days. That is a little more than 2.85 pounds a day for each calf.

Mr. Hoyt does not hesitate to advocate small pens for steers on full feed. More than that, he says he wouldn't take $5,000 for his scales if he couldn't get another. It helps him keep an accurate check on his cattle.

Improves Seed Yield With 2,4-D On Bluegrass

An application of 2,4-D on bluegrass early in spring increased the seed yield tremendously for Gordon Roberts, Holt County. Where no chemical was applied the green seed yield was between 80 and 90 pounds an acre. The other field produced 400 pounds an acre.

It was far more than he expected. In fact, he was not trying to improve yield. His purpose in spraying was to kill weeds to make it possible to strip seed from the field. Mr. Roberts is somewhat at a loss to explain the huge increase. But it was there.

About 20 years ago both fields were under cultivation. In fact it was just one field then. It was turned back to bluegrass and divided for pasture purposes. In the last few years he was able to strip bluegrass seed from the smaller acreage but not from the larger. There were too many weeds in the large patch, which was about 40 acres.

The main weed that was causing trouble was iron weed. It takes a lot of 2,4-D to kill iron weed, so he put a lot on. He mixed 1 gallon and 1 quart of butyl ester with 50 gallons of water and applied 14 gallons of the mixture an acre.

The spray was applied early in May. It got the iron weed in good shape and hurt the white clover growing beneath the grass. It didn't kill the white clover, but it held it back permitting bluegrass to get a head start. From there the bluegrass was on its own and it went ahead to make the 400-pound yield.

In summer after seed had been stripped from the grass, nearly three times as much undergrowth of grass was apparent in the field when comparing it with the smaller area not sprayed. Large amounts of white clover again were growing in both areas.

Cordon Jones, a neighbor who has lived in the community for years, says he has known those 2 fields all his life and had never seen them look like they did this year.

Killing weeds did help the grass along. It is quite probable, too, that holding back the white clover temporarily gave the bluegrass a better chance to grow. But that alone hardly seems sufficient to explain the large difference in yield.

This year may be a different story, Mr. Roberts points out. But last year he traded $4.50 in chemical for $32 in grass seed.

—*Missouri Ruralist*

Breed Associations

Beef and Dual-Purpose Cattle

American Aberdeen-Angus Breeders' Ass'n., Union Stock Yards, Chicago 9, Ill., Frank Richards, Sec.

American Brahman Breeders' Ass'n., 2711 S. Main, Room 203, Houston 2, Tex., Mrs. G. R. Sunday, Sec.

American Devon Cattle Club, Meredith, N. H., W. J. Neal, Sec.

American Galloway Breeders' Ass'n., Henry, Ill., R. C. Forbes, Sec.

American Hereford Ass'n., 300 W. 11th St., Kansas City 6, Mo., Jack Turner, Sec.

AMERICAN MILKING SHORTHORN SOCIETY, 4122 S. Union Ave., Chicago 9, Ill., W. J. Hardy, Sec.

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American Red Danish Cattle Ass'n., Fairview, Mich., Clifford Shantz, Sec.

American Scotch Highland Breeders' Ass'n., Henry, Ill., R. C. Forbes, Sec.

American Polled Shorthorn Society, 7 Dexter Park Ave., Chicago 9, Ill., C. D. Swaffer, Sec.

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American Kerry & Dexter Club, Independence, Ia., John Logsdon, Sec.

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American Spotted Poland China Record, Moberly, Mo., Van G. Sutliff, Sec.

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Chester White Swine Record Ass'n Rochester, Ind., Levi P. Moore, Sec.

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The Farmer's Handbook—By John M. White, County Agent and Soil Conservation Specialist, Okla. A & M College. Univ. of Okla. Press. $4.95.

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We are tenants of the Almighty
Entrusted with a portion of His Earth
To dress and keep
And pass on to the next generation.

—*Louisiana Dunn Thomas*
Negro Share-cropper Mother.